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TRAFFIC ACCIDENT RESEARCH UNIT

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Re-issued as Research Note
RN 7/80 on 5th August 1980.

DEPARTMENT OF MOTOR TRANSPORT NEW SOUTH WALES

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Note: This is a research report and reflects the author's views which are not necessarily endorsed by the Department. It does not reflect any intention to introduce interlocks of the kind described.

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TRAFFIC ACCIDENT RESEARCH UNIT

RESEARCH NOTE RN 7/80

Breath-Alcohol Vehicle Interlock

INTRODUCTION

Investigations by the New South Wales Department of Motor Transport's Traffic Accident Research Unit over the past two years, into ways of reducing excessive drink-driving, have led to the firm conclusion that the best approach is one covering a wide front which should include some means of attempting to change the behaviour of drivers and riders directly, rather than relying entirely on attempting to change their attitudes to drink-driving which is particularly difficult when riders and drivers are already under the influence of alcohol. This view has received support both in Australia and overseas, but no effective method of changing behaviour directly has been developed so far.

An effective method should take into account at the least, the important factors that are discussed below.

Accuracy

The method should select accurately for behavioural change, those motor vehicle drivers (and motor cycle riders) whose blood alcohol concentration exceeds the legal limit for driving (80mg/100ml in N.S.W.) or some higher level nominated by law. It should have a very low probability of wrongly selecting drivers having lower (legal) concentrations; a safety margin above the nominated level might have to be chosen, in order to keep this probability low. Since about half the drivers who are convicted of drink-driving offences in New South Wales at present have concentrations over 150mg/100ml, this higher level may well be a suitable starting point for direct behavioural modification. Other advantages of such a setting include assisting people with serious problems of addiction to alcohol, and of having as a target, drivers with greatly increased risk of crashing. In practice it will probably be found that a working margin for any alcohol meter will have to be set. That is, all drivers when over 150mg/100ml should probably be affected, but none when below say 100mg/100ml.

Public acceptance

A device that tests the breath of drivers before they can drive away, presumably would need time to operate. To the driving public in general, there is probably no minimum time that could be chosen, sufficiently short that it would not produce very unfavourable reactions.

Development of a new device might eliminate the waiting period whilst the device operates; it might even be possible to eliminate the need for the driver to pick up a container and blow into it. If these problems could be overcome, it should become feasible to consider fitting a breath-interlock to every vehicle, even those driven by total abstainers from alcohol drinking.

A device for universal application could then be considered for inclusion in Australian Design Rules for Safety in Motor Vehicles, although the long leadtimes required for implementation in the first new models, and into a sizable fraction of the car population, would possibly be unacceptable. These could of course be overcome by a programme of compulsory retrofitting of all vehicles, over a period of a year or two, say.

If however, there remained a measurable time delay, and the necessity to lift a tube and blow into it, universal fitting would probably be intolerable. The device might then have to be restricted to vehicles normally operated by convicted drink-drivers, and probably only by repeat offenders or by those convicted at levels of 150 mg/100 ml or more. Assuming the latter, considerable support for such a method could be expected from the public at large, from medical authorities and some other professional groups.

However the device is eventually used, it should permit affected drivers to drive when sober. That is, any interlock should only come into operation when excessive drink-driving is attempted. In this respect, the interlock approach differs radically from licence suspension, which does not encourage suspended drivers to remain sober when they wish to drive, but simply bans all driving.

Tamper proofness

Any successful device should be very difficult to destroy or by-pass. No device can be 100 per cent tamper proof, or it could not be serviced. Therefore a periodic inspection system might prove to be necessary, to ensure continuous operation of the interlock system. The availability of sober friends to start the car is a possibility but would probably not occur sufficiently often as to spoil the deterrent effect of the device.

The size of the market.

If required by an Australian Design Rule, the market in Australia alone should be around ½ million units annually. Mandatory universal retrofitting would increase this. Restricting use to convicted drink-drivers should still leave a market for around 7,000 units a year in New South Wales alone.

Note: Devices that do not estimate blood alcohol concentration but only measure impairment due to alcohol, such as the PHYSTESTER, are unacceptable (cf. "A critical evaluation of the Phystester : a test for driver impairment", General Motors Engineering Staff, paper 4987).

INVITATION TO TENDER

From the above introductory remarks, it will be clear that the next step in the process of developing a suitable device, is to invite manufacturers to supply to the Department a few prototypes for evaluation. At this stage no firm commitment can be made by the Department to place subsequent orders for mass production. Instead, the Department proposes to assess each tender on its merits, to place orders for a few prototypes in respect of any or all suitable tenders, to reserve the right to negotiate with any tenderer, to reject all tenders if necessary and to publish its findings. It is then likely to make a recommendation to the Government of New South Wales regarding the future of this proposal for control of drink-driving. The attached specification is intended as a guide to those organisations having manufacturing capabilities or suitable licensing arrangements for manufacture.

SPECIFICATION FOR THE DESIGN AND SUPPLY OF PROTOTYPE BREATH-ALCOHOL INTERLOCKS FOR FITMENT TO VEHICLES

Tenders are invited for the design and supply of three prototype interlocks for fitment to motor vehicles. Each interlock shall determine the level of alcohol concentration by analysing a deep lung sample of breath of a potential driver and shall prevent vehicle operation at a predetermined level of alcohol. Each successful tenderer will be required to design and supply three units in accordance with the requirements below. The tendered units will be evaluated by the Department, or by its representatives. This specification is intended to serve as a guide to requirements.

The Department may decide at a later stage, to prepare a further specification oriented to large scale production of an interlock system.

More than one tender may be accepted. Unless otherwise agreed, the prototype units shall remain the property of the Department.

All costs associated with the design, supply and delivery of the three units, in accordance with the following specification, shall be borne by the tenderer, unless otherwise agreed between the tenderer and the Department. Where any additional costs may be involved, these are to be clearly advised in the tender. Where required, any costs will be paid only after compliance with the specification has been shown. Determination of compliance will be made as soon as possible and probably within 3 months of delivery of the tendered units. This may include physical (ergonometric), mechanical and electrical tests (if necessary) and chemical tests. For example the chemical tests may be designed to determine the response of the system to blood alcohol concentration at the 80 mg/100 ml level in a person's breath using actual blood alcohol concentration measured by accepted chemical analysis of blood and/or breath samples of that person. Details of the types of tests that possibly will be undertaken to determine compliance with this specification are given in Attachment A.

Where devices incorporating the system are tendered and are, or may be, subject to patent or licence agreements such conditions shall be specified by the tenderer. The Department's position with respect to such agreements shall be advised in the tender.

Tenders shall be delivered to the Superintendent, Traffic Accident Research Unit, Department of Motor Transport, 56 Rothschild Avenue, Rosebery, N.S.W., closing time . Delivery of the three units incorporating the system shall be made no later than three calendar months following receipt of any official order from the Department.

Specification

(1) The interlock system shall be designed for fitment to any common model of motor vehicle or motorcycle.

(2) The interlock system shall be capable of monitoring and responding to the alcohol in the breath of the potential driver. It shall be designed and connected to the vehicle so as to prevent starting the vehicle when the blood alcohol concentration equals or exceeds 80 mg/100 ml but not when it is below 50 mg/100 ml.*

(3) The system components shall be of such a size and shape as to allow relatively easy fitment to the bulk of vehicles and motorcycles currently in use in New South Wales. The system shall be capable of being fitted to a vehicle, by any one trained person within two hours, with no more than one assistant.

(4) The system components shall not be located or shaped so as to be a potential source of injury in the event of a collision. The unit shall be designed to be operated by the driver/rider from the seated position.

* Mass produced units may be required to be set at 150mg/100ml and 100mg/100ml respectively.

(5) The system shall be designed to allow the vehicle to be operated by a sober driver within ten seconds of having sat in the driver's seat. Once started the vehicle shall not be prevented by the interlock from operating continuously. The system, after having once prevented vehicle operation by virtue of the driver's breath alcohol level, shall be ready after 5 minutes to be recycled.

(6) The system may be designed having separate discrete components and/or incorporate existing vehicle components. However, no component of the system shall be offensive by way of odour, sound, location, shape, etc. or interfere with the driving conditions normally afforded by the particular vehicle to which it is fitted.

(7) The design of the system shall:-

(i) not allow access to or tampering with any of the system components that are essential for the effective operation of the system. For example, the system components may have to be encased or sealed such that access to them can only be made by obvious breakage of the system component's casing(s) or seal(s), or by a person having the requisite tools (and authority) to gain access to the system components for effecting repairs to the system. Changes of exposed wiring shall not allow interference with the system.

(ii) not allow the system to be by-passed or removed without breaking any of the system's casing(s) and or seal(s). That is the system must first correctly monitor the blood alcohol concentration of a potential driver before the vehicle can be made to operate. Where any component(s) of the system is or are made to control a function or functions of any vehicle component for the purposes of starting the vehicle, the system shall be designed such that operation of that particular vehicle component by means other than via the interlock system will not be possible. Also whenever any attempt to by-pass the system is made, the system and hence the vehicle will be made inoperable, to the extent that before the vehicle can be started repairs will need to be made to the system by a person having the requisite parts and knowledge of the operation of the system. (Such parts should include special tools, codes, etc. for unsealing and resealing or for obtaining access to the system components for effecting any repairs).

Note: It is possible that vehicles fitted with the interlock system will be required to undergo periodic physical inspection to ensure that the system has not been tampered with. The inspection will be carried out by a person trained for this particular purpose and should be capable of being performed within five minutes. The inspection shall merely consist of a physical check to ensure that the system's casing and/or any seal(s) have not been broken.

(8) The system shall be designed (or be capable of being modified) for fitment to vehicles having various types of powerplants e.g. petrol, two stroke, LPG, diesel, electric, etc.

(9) The system shall include any operational instructions in the English language that will need to be observed to correctly operate the interlock system. Instructions in English describing the method of fitment of the interlock system to the vehicle, shall also be supplied.

(10) Three units incorporating the system shall be supplied. Two of the units are to be fitted, by the tenderer, to vehicles nominated by the Department ready for use (for evaluation purposes). The other unit is to be delivered in a condition suitable for bench testing. That is it should be mounted, contained or secured to a rigid member, with an audible or visible indicator simulating vehicle starting.

ATTACHMENT A

TESTING PROCEDURE FOR DETERMINING COMPLIANCE WITH THE ATTACHED SPECIFICATION FOR AN INTERLOCK SYSTEM

The following general testing procedure is given as an indication of the scope of tests that may be undertaken to determine compliance with the attached tender specification.

Specific tests have not been included, owing to the large number of possible combinations in system designs and the vehicle components to which the system may be attached and/or control. In addition it is not desired to restrict or discourage new developments in breath alcohol interlock systems by specifying a detailed performance or testing procedure that might be too restrictive. Further as this tender is to a large extent part of an evaluation and information gathering process by the Department, specific test procedures at this stage might not be warranted. However, where a tenderer advised that costs may be involved, provision may be made for the preparation of a detailed testing procedure, especially suited to that tenderer's particular system design.

Physical (ergonometric) tests

These may include tests to determine, on vehicles or motorcycles:-

(1) The relative ease with which the system can be operated by drivers of various physical sizes, while seated in the drivers seat. (Requirements 4 and 5).

(2) Spatial or visual restrictions (if any) placed on the driver, resulting from the fitment of the system. (Requirement 6).

(3) Physical exertions required by the driver to operate the interlock system e.g. excessive forces to operate levers, require excessively high breath pressures to activate the system, etc. (Requirement 6).

(4) General aesthetic appearance of the system when fitted to any of the bulk of vehicles currently used in New South Wales. This will be a subjective test and is given to dissuade the use of systems incorporating loose wiring or generally indiscriminately mounted, unsightly components. (Requirement 6).

Electrical tests

These may include tests to determine:-

(1) Any adverse effect on the electrical system of the vehicle, resulting from the fitment or operation of the system. (It should not cause any interference with or malfunction of any electrical component or device fitted to the vehicle). Also where the system is to be continuously powered by the vehicle's battery it should not draw more than 1 watt. (Requirement 6).

(2) The reliability in starting the vehicle when breath alcohol is borderline, the response or recovery times of the system between breath samples and the ability of the system to allow restarting of the vehicle. (Requirements 2 and 5).

(3) The accessibility of the system components. These tests will include insulation tests to make electrical contact(s) with components of the system that are essential for the effective operation of the system, without obvious breakage of the system casing(s) and/or of seal(s), or any other seal via which the system may be attached to any vehicle component. (Requirement 7).

(4) The ability of the system to detect and prevent operation of the vehicle when attempts are made to modify the system. (e.g. simulate effective removal or disabling of the system). (Requirement 7).

(5) Attempts to by-pass the system by rewiring vehicle components whose function is controlled by the system to try to by-pass the system, i.e. to try to start the vehicle by means other than via the system. (Requirement 7).

(6) The effectiveness of the system to disable the vehicle and itself become inoperable, unless repaired, when attempts are made to tamper, modify or by-pass the system (as in tests (3) to (5) above). Repairs to the system should only be capable of being effected by a person having the requisite parts and knowledge of the operation of the system, special tools, codes, seals, etc. (Requirement 7).

Mechanical

These may include tests to determine:-

(1) Relative ease of fitment of the system to the bulk of vehicles and motorcycles currently in use in N.S.W. This may include a consideration of the cost and time for fitment. (Requirements 1, 3,8 and 9).

(2) Method of securing to the vehicle. The system components should be securely mounted so as to minimise noise and the possibility of becoming dislodged. (Requirement 6).

(3) Relative strength of the system components. The components should be sufficiently robust to withstand any forces on the system resulting from normal driving conditions. (Requirement 6).

(4) The location of the system components as possible sources of injuries in the event of a collision. (Requirement 4).

(5) Relative ease to by-pass the system. Tests may include:

(i) The effects of removing or disabling the system. Attempts will be made to remove and/or disable the system without breaking any casing or seals. (Requirement 7).

(ii) Attempts to by-pass the system. These tests may include replacing the system and/or the vehicle components controlled by, or which augment the system to operate the vehicle. Such attempts should not be possible without breaking any casing or seals. (Requirement 7).

(iii) The accessibility of the system components. These tests will include attempts to gain physical access to the system's encased or sealed components. This should not be possible without breaking any casing or seal(s). Where any case or seal has been broken in the attempt to by-pass the system, the system and hence the vehicle should become inoperable. (Requirement 7).

(6) The relative ease with which the system may need to be modified for fitment to vehicles having various types of power-plants, (e.g. L.P.G., diesel, electric, etc.) and to motorcycles, if possible. (Requirement 8).

Chemical tests

These may include tests to determine:-

(1) The accuracy of the system in detecting, discriminating & responding to breath alcohol. This will most likely be done with persons having various amounts of alcohol concentration in their blood, and with standardised concentrations of alcohol. (Requirement 2).

(2) The compounding effects of other gases, present in the human breath and the road environment, on the interlock system. These gases may include carbon monoxide, nitrous oxides, hydrocarbons, etc. (Requirement 2).

(3) The effects of ambient temperature and pressure changes on the system performance. Tests may be conducted over the ranges of temperature and pressures within which the system may be required to operate when fitted to a vehicle operable in New South Wales. (Requirement 2).

(4) The effectiveness of the system to monitor a fresh deep lung sample. Where the system does not need to monitor a deep lung sample by virtue of its design, the tenderer will need to demonstrate, conclusively that the breath sampled by the system truly reflects the deep lung concentration. (Requirement 2).

General

Cost will be considered. Besides the capital cost per unit, the following costs may also be considered.

(1) General repair costs for major components - particularly proprietary components.
(2) Maintenance and running costs.
(3) Availability of systems, parts, repair facilities, etc.
(4) Inspection frequencies required to ensure that the system is operating correctly (i.e. frequency of system calibration).
(5) Cost of returning vehicle to original condition after removal of unit.