TECHNICAL BULLETIN No 059 **2012 Pavement Marking Series**

Line Visibility for the Older Driver

(The Eyes Have It)

As a world leader in glass bead technology Potters has been involved in research and development of pavement marking methods / systems for many years. The aim has been to assist industry in achieving optimum performance from Potters range of glass bead road safety products. The outcome of this research and development is provided to Potters customers as Technical Bulletins.

Line Marking – A Fundamental of Basic Road Safety.

- **If you are driving below the legal speed limit at night but cannot see which way the road goes; you (and others) are in danger;**
- **If you obey the advisory speed warning sign at night but can't clearly delineate where the bend in the road is; you (and others) are in danger;**
- **If road safety education has convinced you to indicate clearly when you are changing lanes but you can't see where the lanes are; you (and others) are in danger.**

Furthermore, even if poor line-marking does not lead to an accident at a specific location, navigating your way on a road with limited or no delineation can create additional stress and fatigue for the driver, which could lead to an accident. Currently, advertising campaigns targeting drivers and crash tests highlighting vehicle safety performance are regularly reported in the media. Unfortunately the critical third element of road safety, the road environment, appears to be a less popular subject. Road safety strategies build on the expectation that basic visibly-safe road markings already exist. This is sadly, quite often not the case.

Older Driver Needs. Studies suggest that after age 21, we require 20% more light for each 13 years we age, to see as well as we did at age 21. This is a major issue for older drivers who want to maintain their mobility and safe driving; hence line marking becomes an even more critical issue. Older drivers and the environment interact in the driving task. Driving is a series of decisions based 90% on visual clues. Peripheral vision is far more important than generally recognised for driver orientation, and the visual field of 175° at age 20, declines to 150° by age 70. Both the speed and level of adaptation to light degenerate with the ageing process. Any action that can be taken to increase the visual aspects of driving will be proportionally beneficial. Strengthening the visual message from the roadway can help counter the effects of visual impairment.

Retro-reflected light generated by vehicle headlamps and returned from painted road marking, sends messages to the driver to direct them on a safe road travel path. Due to the ageing process, the older driver does not receive the same messages as the younger driver which can lead to driver disorientation characterised by road run off or head crash type accidents. This situation becomes worse on a wet night when our road markings can become invisible to the older driver.

The Victorian Parliamentary Inquiry into Road Safety for Older Road Users (September 2003) included the following: The Inquiry found the second most common cause of crashes by older drivers was the driver losing control of the vehicle and colliding with an oncoming vehicle or an object off to the side of the road. Vicroads quoted in their submission six identified issues, one of which was the difficulty older drivers have in following pavement markings. Many of the operational difficulties faced by older drivers are primarily due to system-wide maintenance

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short-comings such as faded line pavement markings. Safety reviews of existing roads are therefore needed on a regular basis concentrating on sign and road delineation clarity.

USA and Europe agree on the required fix. Research conducted by Zwahlen and Schnell (University of Ohio) found "Adequate modelling of pavement marking visibility as a function of age is important in determining the minimum pavement marking retroreflectivity requirement". As was expected, it was found that observer age has a highly significant effect on pavement marking visibility. The European Commission Directorate General Transport, in a report entitled 'COST 331 Requirement for Horizontal Pavement Markings (1999), stated: "The conclusions show that there is a need to establish a national policy (taking account of driver age, headlamp intensity and glare from opposing traffic and climate) for roadmarking design, due to their influence on road safety. To do that, the scientific basis – and evidence – provided in the Report, COST 331 can fruitfully be used".

US Visibility Study. The US based Committee on Visibility has established that for nighttime low-beam driving, a driver requires a minimum recommended road preview time of 3.65 seconds when travelling at 88.5 km/hr. (The 3.65 seconds includes 3 seconds for desirable preview time, plus an eye fixation time of 0.65 seconds)
It has also been established that older drivers require road-markings with a minimum retroreflectance of 100mcd/lux/m² for nighttime low-beam driving conditions to be adequate. Line width and whether the lines are continuous or discontinuous are also factors which contribute to achieving this minimum driver visibility level of safety.

Which of the five lines pictured above, would you want your parents to rely on when driving home on a dark stormy night?

Potential Exponential
Using the European Visibility model, consider a motorist travelling at 88.5 km/hour on a road with longitudinal line marking with CIL values of 350 mcd/ lux/m². A standard dashed 100mm wide centre-line (of 350mcd) by itself will provide a preview time of only 2.14 seconds. A continuous 100mm wide centre-line of the same CIL value by itself provides a preview time of 3.33 secs. (55% improvement). The addition of a 100mm wide edgeline will provide double the preview time. (i.e: A dashed centre or lane line with a continuous edgeline provides 4.28 seconds preview, while a continuous centre-line with a continuous edge-line will provide a 6.66 sec preview time (all markings of 350mcd value).
The European model suggests that at speeds of 100 km/hr on a road with a 3m line /9m gap centre line pattern and continuous 100mm wide edge-lines requires the markings to measure a minimum CIL of 200 mcd/lux/m^2 to be considered safe (for younger drivers).

Independent References. The Australian Institute of Traffic Planning and Management (AITPM) says that line marking, which is described as "an essential element of a modern road system", is the most cost effective road safety measure. Line marking can reduce car accidents by as much as 60%, the report says, and with correct levels of contrast and brightness the reflective lines can prevent crashes on bends at night on rural roads. (D. Brown 2004 www.aitpm.com.au). In 2004, the incumbent chairman of the NSW State Government's StaySafe committee Mr Paul Gibson, said the simple white reflective lines dividing a road were just as important safety measures as speed cameras and random breath tests. "I believe line marking is the most fundamental counter-measure ever introduced into road safety", Mr Gibson said. "It is not just about dividing a road, but it is the delineation of the edge of the road that has saved lives". (Sydney Morning Herald, 12 May 2004).

And what's good for the older driver will also be good for the younger driver.

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