Roadmarking 2020: A vision of the Future

This paper looks at the significant trends affecting the roadmarking industry to act as a guide to stakeholders in planning for their place in the industry in the future.

We look at where the industry was 12 years ago, at the time of the first Australasian conference, to focus on developments that have affected the industry since then.

The presentation then looks at trends that are likely to be significant: including the aging population, localities where growth will occur and growth of tourist and agricultural transport. Other influences will be improvements in vehicle safety technology, environmental considerations and engineering safety interventions.

The industry is moving from carrying out a maintenance activity to a capital project safety approach. This involves a close working relationship between RCA, contractor and supplier to arrive at optimum solutions.

1.0 The industry looks forward in 1992

Why 1992? That was the date of the first Australasian Roadmarking Conference. In looking forward, it is often helpful to look back. We start by taking a snapshot of the industry at that time and look at the topics that were addressed at the Conference held that year.

1.1 Roadmarking in 1992

In New Zealand the industry comprised mostly family owned business. Several had moved or were moving into second generation ownership.

Marking was carried out mostly on a six-monthly remark cycle using solvent based paint. In reality on moderate traffic volume roads, markings seldom lasted longer than two months and there were long periods of time with effectively unmarked roads.

Less than 10% of the network was reflectorised and in any event, the solvent binder system was one that was not effective at holding beads.

Thermoplastic was used as a marking system in several major urban areas, with virtually all markings installed as flat markings.

The marking activity was usually contracted as a stand alone contract, with the exception that marking on reseals was usually carried out as a subcontract under reseal contracts.

1.2 Conference topics in 1992

1.2.1 Quality Assurance

Several papers discussed work leading to the introduction of Quality Assurance requirements for the industry. In advance of compulsory Transit New Zealand requirements, the NZRF had mandated QA requirements for its members.

1.2.2 Traffic Control

Appropriately the conference looked at traffic control for the industry. Our ongoing concerns with this are appropriate, given the balancing of the high level of cost of operating effective traffic control, and recognition of the risk to those working in the industry, and motorists encountering a roadmarking operation.

1.2.3 Improved technologies

Among the technologies that were addressed at the conference were:

- the use of large size roadmarking beads with thermoplastic or epoxy binders, as an effective wet night visible marking system,
- waterborne paint technology, which had been first installed on a commercial basis in California less that 10 years previously

- profiled roadmarking systems, which were developed in 1985 by Prismo in the UK as Vibraline. Results of trials of the marking system over the period 1988 to 1990 were demonstrated, including a 1988 survey on the M4 which showed cost of installation was made up through savings on the cost of repairs and replacement to signs and other roadside furniture.

1.3 Significant developments since 1992

1.3.1 Materials

Waterborne paint technology has become accepted as the most durable paint marking system, and is considered to blur the line between 'paint' and 'long-life' marking systems. The limitations around climatic conditions where waterborne marking systems can be installed is better understood, while the MetService .forecasting information is a useful tool for contractors. At present use in New Zealand is around 50/50 waterborne/solvent marking systems.

Thermoplastic has been joined by cold applied plastic as a widely used marking system that offers the advantages of being able to be applied in a profiled or embossed format as an audio tactile and wet night visible marking system.
The reflectorisation of markings is now routine, and there are technologies available that offer visibility of markings in wet night and rain conditions.

1.3.2 Application technologies

Work by contractors and suppliers has identified various application technologies that have improved the performance of markings, or assisted in improved contractor efficiencies.

1.3.3 Performance Based Contracts

The introduction of performance based contracting involved the agreement on, and setting of performance criteria, and technologies for effective measurement and reporting.

1.3.4 Increased Regulatory Environment

There have been significant changes in the regulatory environment in which contractors work. Changes have occurred with Health and Safety, HSNO and RMA compliance requirements, driving hours and logbooks and environmental compliance. The days of operating a business from the cab of a truck are long gone, and contractors are finding that they need to access a broader base of expertise to manage industry risks.

1.3.5 Communications and computer technology

While not exclusively a roadmarking industry element, improvements and new technologies have led to efficiency and changed the way we all carry out our work.
Ongoing reductions in cost and the introduction of new technologies provide opportunities for improvements.

2.0 Trends likely to impact.

2.1 Population trends

New Zealand's population is expected to increase by 0.7% per year over the review period.

Currently 75% of the countries' population lives in the North Island, with 50% living in Northland, Auckland, Waikato and Bay of Plenty.

Almost all of the expected growth in population will occur in the North Island. Population declines are expected to occur in Gisborne, Taranaki, Manawatu-Wanganui, West Coast and Southland.

New Zealand's population is also aging. The 'baby boom' generation is moving into old age as the birth rate continues to decline, as it is in other developed countries. In the early 2020's the median age of New Zealanders will be 45, compared with 35 in 2005. The percentage of people over the ago of 65 will increase from the current 17%, to around 20% over the same period.

2.2 Car ownership

New Zealand has the forth highest car ownership rate in the world, behind the US, Italy and Australia. Growth over the past two decades has been steady at 3-4% in total traffic, and 5-6% growth in heavy traffic.

2.3 Tourism

Tourism is an important sector of the economy and contributes around 10% of GDP. Tourism is forecast to grow over the review period with international visitor growth growing faster than domestic tourism. International arrival numbers are forecast to increase from 2.3 million in 2004 to 3.2 million in 2011, averaging 4% growth per year. This demand can be volatile and is susceptible to external events. Of significance is the move from tourists travelling as part of tour groups, to a higher level of independent travellers.

Domestic tourism is forecast to grow at around 1% per annum.

Tourism is focused on Auckland, Rotorua, Canterbury, Queenstown, West Coast, Nelson and Fiordland.

Key tourist routes are SH1 from Northland to Wellington and SH 2 to the Coromandel, Tauranga and Napier. In the South Island the key routs are SH1 from Picton to Bluff, SH6 on the West Coast, SH8 to Queenstown and SH94 to Milford Sound.

2.4 Road Freight

Assuming economic growth continues at its present rate, by 2020 the amount of freight transported around the country is expected to double from present levels.

Auckland, Waikato, Bay of Plenty and Canterbury will experience the highest growth in freight transport activity.

Little of the increase can be transferred to rail, because of time sensitivity and lack of access to the rail network.

2.5 Vehicle Safety Standards

Over the past two decades there has been increasing emphasis on improving vehicle safety standards.

This had been driven partly through consumer demands, and by manufacturers marketing. Lagging behind the introduction of safety standards by progressive manufacturers, state regulators have introduced higher safety standards for vehicles on a staged basis.

Safety features fall into two main categories:
Active safety systems use information about a car's external environment to change the response of the vehicle and improve the safety of the vehicle in the pre-crash time period, or during a crash event.
Passive safety systems refers to built-in features of the vehicle such as crumple zones, seatbelts, and airbags, which work passively to prevent injury and do not change their action in response to crash scenario or severity.

Two quite different approaches to using these systems developed.
In one, the driver maintains primary responsibility and control of the vehicle, in the other, the vehicle's intelligence systems takes responsibility for control of the vehicle.

This is important for our industry, because if the latter approach was adopted, the role and function of roadmarkings would be diminished or removed.

The Japanese led work in the area of developing in-car control systems. Using these safety systems, a vehicle would process information provided through a loop imbedded in the roadway, and there would also be communication between vehicles. This 'train' approach would have significant benefits around increasing capacity and safety on the roadway, however it's successful introduction involves co-operation between the road owner and vehicle manufacturers. There are practical difficulties around progressive introduction, there are substantial liability risks and it impacts on the element of 'freedom' which is the promise of owning and driving a vehicle.

Safety systems that provide information to the driver and give limited interventions, have been progressively developed and introduced by German and Swedish vehicle manufacturers, and these technologies over time have been introduced by other manufacturers.

Let's look at some of the active safety systems to understand how they work together with information provided to drivers through pavement marking systems.

A **lane departure warning system** (**LDW**) is a mechanism designed to warn a driver when the vehicle begins to move out of its lane (unless a turn signal is on, in that direction). Most systems involve monitoring through the use of sensors of the position of the vehicle relative to lane markings. If the vehicle moves over the line there is one, or a combination of responses: An audible rumble strip sound is generated on the appropriate side of the vehicle, a warning tone is triggered, a vibration mechanism in the seat alerts the driver, there is response through a vibrating steering wheel, or there is positive steering response by the vehicle.

An alternative approach is the **artificial passenger** (AP) - a device used in a motor vehicle to make sure that the driver stays awake. IBM has developed a prototype that holds a conversation with a driver, asking questions intended to determine whether the driver can respond in an alert manner. A camera could be used to evaluate the driver's "facial state" and a voice analyser to evaluate whether the driver has becoming drowsy. If a driver seems to display too much fatigue, the artificial passenger might be programmed to open all the windows, sound a buzzer, increase background music volume, or even spray the driver with ice water.

Electronic Stability Control (ESC) is the generic term for systems designed to improve a vehicle's handling, particularly at the limits where the driver might lose control of the vehicle.

ESC compares the driver's intended direction in steering and braking inputs, to the vehicle's response, via lateral acceleration, rotation (yaw) and individual wheel speeds. ESC then brakes individual front or rear wheels and/or reduces excess engine power as needed, to help correct understeer (plowing) or oversteer (fishtailing). ESC also integrates all-speed traction control, which senses drive-wheel slip under acceleration and individually brakes the slipping wheel or wheels, and/or reduces excess engine power, until control is regained.

ESC combines anti-lock brakes, traction control and yaw control (yaw is spin around the vertical axis).

ESC cannot override a car's physical limits. If a driver pushes the possibilities of the car's chassis and ESC too far, ESC cannot prevent a crash. It is a tool to help the driver maintain control.

Matching ESC with good information provided to the driver through efficient roadmarkings will greatly improved safety.

3.0 2020 - The future

In 2007 there are a number of clear messages that the industry needs to understand. These messages are based on policy and future direction that its customers – either motorists or their representatives - central and local government have included in policy planning documents.

We will discuss these as they may impact on the industry and we then look at examples of some technologies that the industry should be thinking about.

3.1 Government Transport outcomes

Over the next decade the government has committed to the following three priorities:

- Economic transformation
- Families, young and old
- National identity

The transport sector is primarily focused on economic transformation, in particular:

- Increasing international connections of firms to overcome constraints of size and distance
- Improving the value derived from sustainable use and management of natural resources
- Ensuring efficient use of existing transport infrastructure and high-quality investment in transport.

3.2 Sustainability and Safety

Sustainability has become a key focus for government agencies.
The industry can provide a number of methods for better management of resources that would lead to reduced environment impact and better use of resources.

Selection of a roadmarking system solution should be a factor of both best life cycle cost and the desired safety outcome.

3.2.1 Design

With better emphasis on design, contractors can work with road controlling authorities to arrive at optimal solutions in selection of materials.

These should match marking systems to the pavement surface on which they will be installed. An optimal solution would be to match the marking system life to that of the pavement surface, however environment factors such as winter maintenance consideration or the impact of heavy vehicles should be factored into design decisions.

The marking system design should also take into account the desired safety benefits by considering; night visibility, wet night visibility, visibility in condition of raining and audio tactile massages that are desired.

3.2.2 Cost benefit tools

Cost benefit tools are available and more can be developed to assist in design selection, and to provide budget justification. To operate effectively, it is important that there is the ability to assess pavement marking system cost through realistic life-cycle costing, and that funding mechanisms are available to support this approach.

3.2.3 Procurement

Industry experience is that bundling of maintenance activities including roadmarkings into a single contract has not necessarily led to good outcomes for the client or the motorist.

Installation of pavement markings and other delineation devices has important safety implications, and an industry view is that good outcomes are more likely where the road controlling authority has a direct contractual relationship with a roadmarking contractor.

3.3 Road Safety Strategy to 2010

The Government's 2010 Road Safety Strategy, had an objective that by 2010 NZ would have fewer than 300 road fatalities and 4,500 hospitalisations. The strategy identified that this would be achieved through a combination of initiatives around:

- Engineering
- Education
- Enforcement

The strategy identified that all initiatives would come at a cost.
In common with other countries that have developed strategies to reduce their road toll, early and substantial improvements are achieved at little cost through education.

Enforcement needs to be carefully managed to ensure that the goodwill of the vast majority of motorists is not compromised.

Once these gains are made, improvements tend to come at considerable cost because most engineering solutions involve construction on new roadways or retrofitting of existing roads.

Our industry however has technologies such as profiled markings and wet night visible marking systems that provide significantly improved safety standards at more modest cost.

3.3 Projects underway

3.3.1 Procurement Procedures

Procurement procedure reviews for physical works and professional services are underway. It is expected that as a result of these reviews, new manuals of standard procurement procedures will be issued. It is possible that there will be greater guidance given to Road Controlling Authorities, about the options that are available to them with contract term and other matters that will better meet local requirements.

3.3.2 Traffic Control Devices Rule

The current programme of review of the Manual of Traffic Signs and Markings will bring the specification up to date and will lead to greater standardisation across all Road Controlling Authorities.

The resultant *Traffic Control Devices Specifications* (TCD Specs) and *Manual for Traffic Control Devices* (MfTCD) are proposed to, respectively:

- detail the specifications for approved signs, signals, markings and other appropriate traffic control devices approved or mandated for use in New Zealand; and
- provide industry best practise guidance on the use of traffic control devices.

The Traffic Control Devices Steering Group has also taken on a role to review proposals for trials of traffic control devices which will allow wider industry consultation when considering trials.

3.3 Technologies

The following are two examples of technology opportunities that are likely to impact on the roadmarking industry, and which contractors should consider for implementation.

3.3.1 Vehicle tracking systems

A vehicle tracking system is an electronic device installed in a vehicle to enable the owner or a third party to track the vehicle's location. Most modern vehicle tracking systems use Global Positioning System (GPS) modules for accurate location of the vehicle. Vehicle information can be viewed on electronic maps via the Internet or specialized software.

Vehicle tracking systems could be used to:

- Locate a vehicle at any particular time
- Assist in managing and monitoring vehicle efficiency, productivity and driver behaviour
- Interface with an asset management database to capture information about the installation of markings
- Provide evidence in the case of complaints or risks of prosecution or litigation
- Assist in the rapid recovery of stolen vehicles.

3.3.2 Technology Convergence

Convergence of technology occurs when multiple products come together to form one product with the advantages of all of them. Rapid advances using communications and computing technology provide such elegant solutions, that we rapidly adopt them.

Think about the way on-line and text banking becomes a better solution than joining a queue at the bank. Or how online airline ticketing with its access to flight schedules, prices, availability, seat allocation and check-in, has replaced delays and inefficiencies in travel.

4.0 Conclusion

Thinking about all these influences, I would like to suggest that there will be three streams of influence that will impact on the industry, and should be taken into account in our planning for the future.

In the first there will be the process of cyclic change. Those of us who have worked with government agencies over time will have observed the cyclic nature of change. If we assume the current proposal for restructuring around Transit New Zealand, Land Transport New

Zealand, and Ministry of Transport is realised, then the 'new' version will look remarkably like an earlier version.

Some trends follow long term implementation. The process of change is based on a need to develop confidence around the process of change.

For our industry there is a move to higher standards of marking:

- Markings visible during the day
- Markings also visible at night
- Markings visible in the wet
- Markings visible in conditions of raining

In 1992, as an industry we delivered the first level some of the time and the second level occasionally. At present, we are delivering the motorists levels one and two most of the time and sometimes deliver at level three. We already have access to technologies to deliver these standards of pavement markings, however introduction, which inevitably involved cost, is introduced on a staged bases, and often at a frustratingly slow pace for those working for their introduction.

Other factors that will influence the industry will appear relatively suddenly and unexpected. Their effect can be quite profound.

Witness the current focus on sustainability and climate change. Thinking promoted by a comparatively small group over several decades enters the mainstream and promoted by government becomes partly a marketing opportunity and then starts the process of being imposed through various government regulation.

Opportunities around the introduction of new technologies tend to work in similar ways. Think about the internet as a trading platform. After initial enthusiasm from early adopters, visionaries work the possibilities of technologies, and then the technologies tend to be integrated rapidly into the way we all do business.

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