Title; Is Innovation a Threat or an Opportunity?

1.0 INTRODUCTION.

In the midst of a recession do we embrace innovation or stick gallantly to the historical strategies and methodologies of the past?

The road maintenance industry is under pressure. Infrastructure is at the core of a Nations well being and has been identified as a key area of investment when planning how to survive the recession. The ongoing maintenance of the infrastructure must therefore be critical if this infrastructural investment is to have a long term benefit.

The environment and challenges we face are unique to or time. Escalating maintenance costs, achieving the pavements design life, optimising usable lane time, creating and maintaining road user's satisfaction are key issues compounded by increasing traffic volumes and axle weights. We have a government that is now spending more money on infrastructure, which is creating an ever-increasing workload. This is happening when there is a serious skill shortage within the industry, which is driving top talent into higher paid jobs, many of which are off shore. This is happening in an industry that for years has not been perceived as sexy; therefore, it has not attracted or developed a talent pool to draw on for the new employees it needs. This is underpinned by increasing expectations for a safety and environmental framework that protects the public, staff and surrounds that are in contact with road maintenance works.

It was in this environment that the South African manufactured BRP Road Patch was introduced into New Zealand. The BRP Road Patch is a prefabricated chip seal and is used primarily as a front line road maintenance tool. It allows a road maintenance crew to waterproof a road defect at the earliest possible opportunity. Restoration of the waterproof seal coat may be all that is required to permanently repair a defect. If the defect is too far advanced and structural deterioration of the pavement has started then the waterproof seal coat will inhibit the rapid growth of the defect area until structural repairs can be scheduled and work completed. The benefits of effective early intervention include reduced costs of maintenance, reduced road maintenance activity, reduced investment required for road maintenance plant and equipment, improved road user safety and consumption of less fossil fuels than alternative maintenance methods.

This paper looks at the benefits this innovation can bring to the road maintenance industry. The benefits are calculated from the road maintenance records of three commercially maintained roading networks in New Zealand.

In conclusion comment is made on the appetite for innovation in these pressured times.

2.0 HISTORICAL SNAP SHOT.

2.1 ROAD MAINTENANCE RECORDS.

The road maintenance records were provided by three Road Controlling Authorities in New Zealand. (Hutt City Council, Porirua City Council and Franklin District Council) They were chosen because they provided a subtle variation in network character and a large variation in geology. All three Network Managers agreed to provide the data as long as commercial integrity was maintained. A total of four competitively tendered road maintenance contracts were included in the data and these contracts were held by three National Contracting Companies.

The Councils were a mix of urban (2) and urban/rural (1) communities.

	Population	Road length	Urban / Rural
HCC	100,000	477 km sealed	Urban
PCC	50,300	237 km sealed	Urban
FDC	43,000	1380 km sealed 242 km unsealed	Urban/Rural

Financial allocation for Road Maintenance activities. (Annual budgets)

	Corridor Maintenance	Rehabilitation	Resurfacing	Total
HCC	$2,380,000	$2,479,000	$2,531,000	$ 7,390,000
PCC	$1,040,000	$1,100,000	$1,045,000	$ 3,185,000
FDC	$4,874,000	$4,900,000	$3,800,000	$13,574,000

Corridor Maintenance by work category (extrapolated from sample area for FDC)

	Corridor Maintenance	Admin	Sealed Pavement	Drainage	Emergency	Other
HCC	$2,380,000	$123,000	$1,192,900	$462,000	$ 0	$ 602,000
PCC	$1,040,000	$125,000	$ 277,104	$128,774	$87,300	$ 422,000
FDC	$4,874,000	$366,000	$2,434,000	$668,000	$67,000	$1,339,000

Total spend on sealed pavement maintenance $3,904,004

2.2 EXISTING INTERVENTION STRATEGIES.

All three Road Controlling Authorities had sound, logical and time proven strategies that related to their networks age, condition, rate of deterioration and surrounding land development activities. (Land development is controlled by the local District Plans) The strategies also related to available funds which over time had proven sufficient to support the strategies. However, it should be noted that network growth demands and inflation have in many areas of New Zealand put significant strain on the road maintenance budgets.

The road maintenance strategies were very similar in principal and reflected the uniform approach adopted in New Zealand based on the criteria set by the New Zealand Government, which subsidises road maintenance. The ten year forward works programme allocates each section of road, a treatment category based on historical records current condition and a forecast rate of deterioration. The ten year forward works programme is revised annually to confirm previous assumptions and the current condition of the road section.

- Treatment Category (10 year plan revised annually)

    - Resealing;
      Based on the age and condition of the seal coat. (waterproof and texture)
    - Rehabilitation;
      Based on the condition of the pavement and maintenance costs.

- Maintenance strategy

    - Pre Surfacing;
      Maintenance work is carried out to a high level to ensure all pavement and drainage repairs are completed before the reseal.
    - Holding;
      A minimum amount of work is undertaken for the two years preceding the rehabilitation. A “keep safe” strategy is adopted.
    - Other;
      Other network locations are inspected at regular intervals, defects identified, treatment selections agreed, prioritised and scheduled to fit within the budgets allocated.

2.3 PAVEMENT MAINTENANCE ANALYSIS

Where was the money spent in 2007/2008? This data is derived from the combined total for all three networks which protects the commercial integrity of the information provided by the Councils. The annual work activity has been summarised into four work items (potholes, cracking, surface repair and structural repair) because they represent the life cycle of the defect. (from loss of waterproofness through to structural failure)

Financial (Actual expenditure)

The average unit rate per item

Pothole	$ 30.23 ea
Crack	$ 7.03 m
Surface repair	$ 28.00 m2
Structural repair	$ 42.45 m2

The average quantity of each treated defect

Pothole	1.0 ea
Crack	57.0 lm
Surface repair	7.9 m2
Structural repair	28.95 m2

The average cost per repair = average cost x average area

Pothole	$ 30.23
Crack	$ 400.71
Surface repair	$ 221.20
Structural repair	$ 1,228.93

The total number of defects repaired

Pothole	7,435
Crack	145
Surface repair	585
Structural repair	2,482

The total quantity of defects repaired

Pothole	7,435 ea	
Crack	8,253 lm	
Surface repair	4,624 m2	(= 6.4% of structural repair area)
Structural repair	71,847 m2	

The total annual expenditures (2007/2008) were...

Pothole	$ 224,758	5.8%	
Crack	$ 58,023	1.5%	
Surface repair	$ 129,471	3.3%	
Structural repair	$3,049,895	78.1%	
Other	$ 441,857	11.3%	
Total	$3,904,004	100.0%	the total expenditure on pavement maintenance for the year. (See section 2.1 above)

2.4 COMMENTARY

What is this information telling us about the network management behaviour?

Three important behaviours are apparent from this information.

1. Crack sealing as a road maintenance activity (excludes the reseal programme) accounted for 1.5% of the pavement maintenance expenditure and a total of 145 sites were treated. This reflects a very casual attitude towards maintaining the integrity of the seal coat.

2. Defects are left too long before an intervention action is deployed. The majority (78.1%) of all maintenance work is left until the pavement requires structural repair. In this work activity the defect size (area requiring repair) is the largest, and the rate the most expensive, making the structural repair the most costly defect type to repair.

3. Preventative maintenance is not aggressively pursued. Preventative maintenance (crack sealing and surface repair) accounts for only 4.8% of the total expenditure.

There is nothing to indicate that this activity contravenes the road maintenance intervention strategy. The strategy may in fact encourage these behaviours because..

a. The "Pre-surfacing" Category – heavy maintenance regime places a lot of emphasis on preparing the road for resealing. This is a high priority and treatment selections are critical (are they overly conservative?) to ensure the pavement survives for the life of the reseal.

b. The strategies are more focused on preparation for cyclic activity such as resurfacing and rehabilitation, rather than on the cost effective intervention strategy relative to the defects life cycle.

2.5 WHY ARE THESE BEHAVIOURS PRESENT?

Intervention strategies for road maintenance have been driven by the reseal and rehabilitation programmes. The road sections identified in these categories are maintained to clear guidelines. The road sections not covered by these categories fall into the "other" category that is given little focus in the strategy beyond being "inspected at regular intervals" and "work scheduled and prioritised to fit within the budgets allocated."

Retaining the "integrity of the waterproof surface at all times" has not had a focus under existing road maintenance practices. The intention of the reseal programme is to maintain the waterproof surface but for the years in between the resealing no mention is made of retaining the integrity of the sealed surface.

For road maintenance, measure and value contracts are the main type of contract used to engage a Contractor. This type of contract does not encourage the review of cost effectiveness with respect to decision making. Typically managing budgets, meeting response times, managing ratepayer complaints, and completing pre-seal preparation in time are the key performance indicators.

The tools available to road maintenance crews have not supported alternative behaviours. The type and quantities of work completed reflect the industries ability (equipment and materials) to respond to road maintenance issues.

3.0 CHANGING THE APPROACH THROUGH INNOVATION

To address these issues an innovative product was introduced into New Zealand in April 2008. The BRP Road Patch allows new strategies for road maintenance to be implemented.

The BRP Road Patch is a prefabricated bitumen rubber chip (aggregate) seal. It needs no equipment for the installation process so is ideal for the front line maintenance crews to use. The skills required to lay a sheet are basic and easily taught. This allows a maintenance crew to waterproof a defect as soon as it is detected.

The strategy for road maintenance can therefore be modified to include a Pavement Waterproof Strategy. The objective of the strategy is to restore the integrity of the seal coat whenever it is compromised. The strategy should have equal importance to the Pre-

surfacing and Holding Strategy. A Pavement Waterproof Strategy may include treating the observed defect at the most cost effective point of the life cycle, (i.e. when it is first observed) reporting the repair then reviewing the reports to determine the root cause of the defect. If further treatment is required it is selected and programmed according to the best whole of life cost principals.

4.0 THE BENEFIT OF CHANGING OUR MAINTENANCE STRATEGY.

By implementing a Pavement Waterproof Strategy the defects are treated earlier in their life cycle. The defects are therefore smaller and less complex. This has an impact on the cost to maintain the network. We can assess the savings by rebuilding the maintenance records and shifting a percentage of the defects back to previous/earlier defect categories.

Note, There is a flaw to merely looking at reducing the average size of the repair, i.e. reducing the average area of a structural defect repair from the existing 28.95m2 to say 15m2. By using the existing repair methodology, the reduction in area of a repair will result in an increase in the cost per square metre. Therefore, to half the repair area may well double the cost per unit and gain no financial benefit. This is merely an equation relating to the outputs that can be achieved by the resources employed. Physical works become cheaper per unit (m or m2) as the size increases and the converse also applies.

4.1 FINANCIAL

From the data collected it is possible to re-evaluate the costs if a change to the intervention strategy was implemented.

In the first example one defect in five has been shifted to the previous defect category.

EXAMPLE ONE

The total number of defects repaired

Pothole	7,435
Crack	262
Surface repair	964
Structural repair	1,985

The average unit rate per item

Pothole	$ 30.23 ea
Crack	$ 7.03 m
Surface repair	$ 28.00 m2
Structural repair	$ 42.45 m2

The average quantity of each treated defect

Pothole	1.0 ea
Crack	57.0 lm
Surface repair	7.9 m2
Structural repair	28.95 m2

The five main defect categories were...

Pothole	$ 224,758	6.6%
Crack	$ 104,986	3.1%
Surface repair	$ 213,237	6.2%
Structural repair	$2,439,421	71.2%
Other	$ 441,857	12.9%
Total	$3,424,259	100.0%
Previous total	$3,904,004	
Saving	**$ 479,745**	

Note this savings figure is 12.3% of the total money spent on the pavement maintenance for the year.

In the second example two defects in five have been shifted to the previous defect category.

EXAMPLE TWO

The total number of defects repaired

Pothole	7,435
Crack	379
Surface repair	1,343
Structural repair	1,489

The average unit rate per item

Pothole	$ 30.23 ea
Crack	$ 7.03 m
Surface repair	$ 28.00 m2
Structural repair	$ 42.45 m2

The average quantity of each treated defect

Pothole	1.0 ea
Crack	57.0 lm
Surface repair	7.9 m2
Structural repair	28.95 m2

The five main defect categories were...

Pothole	$ 224,758	7.6%
Crack	$ 151,869	5.2%
Surface repair	$ 297,072	10.1%
Structural repair	$1,829,873	62.1%
Other	$ 441,857	15.0%
Total	$2,945,429	100.0%
Previous total	$3,904,004	
Saving	**$ 958,575**	

Note this savings figure is 24.6% of the total money spent on the pavement maintenance for the year.

4.2 OTHER BENEFITS

- Earlier intervention consumes less resources per task (labour, plant and materials) resulting in a more efficient service delivery provider.
- Road user satisfaction increases because the defects are repaired when they are smaller and less obvious to the public.
- Safety increases as the occurrence of unsealed defects on the network decreases.
- The cost to the environment decreases as less fossil fuel is consumed per repair site, and traffic is disrupted for shorter periods allowing for a more efficient flow of traffic.

The key to gain these benefits is to successfully intervene earlier in the defects life cycle.

5.0 APPETITE FOR INNOVATION.

In these pressured times it is reassuring to know that the road maintenance industry has a real appetite for innovation. While some approach innovation more tentatively than others, the drive to improve our roading network is evident in most conversations with Contractors, Consultants and Road Controlling Authorities.

The statistical evidence of this is…
Number of Councils introduced to the BRP Road Patch = 57
Number of Councils using the BRP Road Patch = 45
79%

6.0 CONCLUSION.

This paper has reviewed a years road maintenance records and looked at the alignment between the road maintenance intervention strategy and the activity on the network. It has confirmed that the current activity is aligned with the road maintenance strategy.

It looked into what the road maintenance records told us about our current network maintenance operations behaviour. The behaviours were reflective of the machinery and materials available to the road maintenance contractors.

Then the BRP Road Patch was introduced and this allowed the road maintenance intervention strategy to be revised. The strategy encouraged intervention at the earliest opportunity, when the defect was small in area and non complex in character. It identified the need to report the repair so an asset manager could access the defects root cause and assess the need for follow up treatment. If further treatment is required it can be designed and programmed allowing resources to be optimised.

The benefits of the new road maintenance strategy were summerised. From this information it was apparent that an opportunity existed to improve the maintenance management regime resulting in significant financial, safety and environmental benefits.

A quick look at our appetite for innovation, concluded that we are an open minded industry with the desire to improve the way we operate when the opportunity presents itself.

END

Acknowledgements

This paper would not have been possible without the support of

Franklin District Council
Hutt City Council
Porirua City Council
OPUS International consultants (Pukekohe Office)
A J Broom Road Products NZ Ltd

Author; Michael Chadderton, REA

Manager Australasia
A J Broom Road Products NZ limited.