

**IMPERATIVES IN FUTURE ROAD SYSTEM MANAGEMENT
IMPROVED ROAD MAINTENANCE PRODUCTIVITY
THE AUSTRALIAN CASE**

Malcolm Frost

**General Manager
Road Management Division
CSR Emoleum Road Services
Australia**

14th IRF Road World Congress
Paris, France
11 - 15 June 2001

Synopsis

Australian road agencies, like their counterparts across the world, are struggling to secure adequate funding for their roading activities. As community expectations grow across all sectors of government, and the ability to raise additional funding diminishes, governments seeking to maintain appropriate standards and protect the considerable investment in their road asset are faced with significant challenges.

With governments finding it difficult to increase taxes and income, and with increasing social, health, welfare and education demands, the pressure on the public dollar is steadily increasing. At the same time, communities are looking to governments to devote increasing proportions of the roading dollar on improvements to the efficiency and safety of the network. These enhancement costs are also under pressure as the environmental demands on infrastructure investment further increase the cost of network expansion.

Commonly, these pressures result in decreasing availability of funding for maintenance of existing road infrastructure assets. In many countries, the real investment in road maintenance investment is, at best, stable. This is despite the ageing of that infrastructure, growth in traffic and truck loadings, and increasing community expectations for the level of service.

This paper overviews the current situation in Australia, in the context of current debates about the level of service and funding for road maintenance. The review focuses on the need for material improvements in the standard of the road system, and examines options available to government to achieve these standards.

The paper challenges the commonly held view that more investment is needed to arrest the declining state of the roads system. It assumes that the real need is for additional roading output to be invested into the system, and debates the various mechanisms for that additional output to be achieved. It works toward a basic premise that governments should only increase investment (and hence raise taxes and charges) when it can be satisfied that the current investment is being optimally spent.

A number of methods of improving the efficiency and effectiveness of road maintenance are discussed, including a discussion and comparison of the various forms of maintenance contracting being used in the world today. The advantages and disadvantages of each type are reviewed in terms of the technical, financial, economic, social, political and risk factors. Many common views on forms of road maintenance delivery are also discussed, and challenged.

The paper approaches this subject from a strategic viewpoint, aimed at policy and decision makers faced with the challenges of doing more with their available dollar.

Introduction

The Australian road system comprises more than 800,000 km of national, state and local roads. Over 600,000 km, or 75%, of these are rural local roads which arguably are the lifeline of Australia's rural and regional community and economy.

This road system is probably Australia's most significant public asset, with an estimated minimum of US\$120 Billion invested in its creation over the past century, and several times that invested in its upkeep and maintenance. The protection of that investment now and into the future, and the realisation of the value it is designed to generate, is a fundamental imperative for our planners and policy makers.

The vast space of Australia, and the inherent need for us to be able to move our people, produce, goods and other wares around the country, amplifies the value of our road assets well beyond any economic value, right across the spectrum of our social, technical, environmental and political being.

It is essential that Australia finds the means by which we can maintain our existing assets to a standard which is functional and fit-for-purpose, which satisfies the economic and social needs of our community, which is safe to use, and which does not adversely impact on our sensitive environment.

But, are we achieving this imperative, or are we simply putting one of Australia's greatest emerging problems into the "too-hard" basket for consideration by future generations?

Is there any doubt that, overall, the standard of our road system is deteriorating? Roads are getting rougher, there are more failures, they are untidy, reseal cycles are lengthening, and major rehabilitation and reconstruction seems to be a thing of the past. To answer this question we need to listen to the people that matter, the people that use our roads, the people that rely on our road system for their livelihood, or simply just to be able to move about. Listen to those people and you will have no doubt that we have a problem.

Despite this fact, when we hear our public representatives talk about roads, what do we hear? We hear about new works, big motorway projects, investment in improving our roads. But is this investment really improving our road system, or does the diversion of the available road dollar away from maintenance to these statistically irrelevant localised improvements (in terms of the length improved per year compared to the total system length) actually have a negative effect on the efficiency and value of our road system?

This is not to say that these projects are not worthwhile. Each of them is a valuable enhancement of our road system, and addresses serious safety and transport efficiency objectives. But they are not the only priority demanded by our road system. Surely we should be seeing a more balanced debate over road needs, funding and efficiencies, with recognition of the fundamental need to invest in the maintenance of our prior investment.

Unfortunately, as in many developed, and most under-developed countries, we have little objective evidence of the decline in our road system, with limited statistics only reported for the national and state systems. These statistics need to be read with care, because small changes can equate to massive liabilities. For instance, a 0.4% decrease in threshold roughness which would not show up on most statistics equates to an additional backlog liability, in addition to our normal budgets, of more than US\$50 million.

Moreover, there is only a tenuous relationship between the statistics we can measure, and the value of the road asset. This problem is exacerbated by the fact that in spreading the available maintenance dollar further we may be addressing symptoms, such as roughness, but not the underlying problem of ageing and fatigue.

The solutions to these problems are complex. But this must not be a deterrent, with the obligation now on all road stakeholders to work together in implementing a package of initiatives which can address Australia's road legacy.

More money is, and always will be, the most dominant component of the solution. But we all know that money "doesn't grow on trees" and that competing priorities limit access to the necessary funds. It is difficult to see a government reducing spending on health, education and law and order to fund the resealing of rural road systems. Therefore, in addition to an increase in the funding of our road system, we have to "make what we have go further", to do "more with less", to "work smarter", and to be "efficient and effective".

The total solution is not just economic rationalism. It is a solution which embraces and balances all of the social, economic, environmental, technological and political factors which dominate the modern world.

The Case for Increased Funding

One of the unfortunate shortfalls of the Australian road sector is the lack of consistent recording and reporting of roads expenditure. A multitude of different expenditure reporting systems and definitions are in operation across the country, which makes it almost impossible to assemble an accurate view of our road investment. In particular, there are several current approaches for the allocation of certain maintenance investment between capital and recurrent programs. For example, in some states a pavement reconstruction is classed as a maintenance expenditure, whereas in others it is classed as a capital item. These problems have and, unless resolved, will continue to distort studies by bodies such as the Grants Commission and the National Road Transport Commission.

Despite the above, it is possible to estimate that the annual road maintenance expenditure across all levels of Government in Australia is in the order of US\$3 Billion.

A simple "rule of thumb" analysis of the situation demonstrates that the funding of the maintenance of Australia's road system is inadequate. If we assume that the US\$120 Billion asset (which excludes the value of land under the road) has an average "life" of 100 years, the annual "depreciation" of the asset equates to US\$1.2 Billion. Assuming that the

achievement of this 100 year life requires resurfacing of sealed roads at 15 year intervals, and some form of major strength restoration work at periods of 30 years, we require annual investments of US\$300 Million and US\$2.1 Billion respectively. On top of this we also require a further US\$1.2 Billion each year for the day-to-day routine maintenance (potholes and failures, shoulder works, unsealed roads, drainage, signs and lines, roadside amenity etc).

This simple analysis, which is based on conservative estimates of life cycles and asset extent, suggests an annual investment of US\$4.8 Billion. Compare this to the actual annual investment of US\$3 Billion, and the extent of the problem is graphically illustrated.

But this is not the only evidence. Is there any road asset manager in this country who would honestly say that they have access to the level of funding required for them to professionally manage their asset values and to consistently deliver a level of service which fully meets the needs and expectations of their customers, the road users?

But again, this assertion is difficult to prove objectively. Current attempts to measure movements in asset value for financial reporting are distorted by the existence of multiple methodologies, and of the lack of a systematic approach for the measurement of the real value of a road asset. If the value of an asset is a measure of its “fitness for purpose”, and if the purpose of a road is to facilitate the movement of people and goods, then a realistic valuation must include consideration of the load carrying capacity of the road, its strength. But this is most often not the case.

Hence, we have a self fulfilling prophecy, whereby the shortage of proper funding forces agencies to invest their limited funds in short-term repairs which do little more than dress-up the surface, filling and smoothing roughness and deformities and chasing failures. Hence, we are spreading the money thinly over a vast area, rightly seeking to maintain a “smooth” system, without really addressing the underlying problem of asset ageing, fatigue and structural failure. The problem is that this approach manages the one measure of condition most commonly used to assign value, roughness, which in turn drives the valuation methodologies to report only marginal changes in asset value. Using these results, Government Treasurers determine that the road system is under control, and hence have no incentive to allocate more funding. The merry-go-round continues.

So, without any realistic, objective, measure of the adequacy of our funding we can only rely on intuitive methods, such as the one above, or the opinions of the two key stakeholders, road owners and road users. As I have already assumed, it is unlikely that there are too many road asset managers who would agree that their funding is adequate. But what do the users say?

In early March 2000 Australian road owners and users presented their views at the first National Rural Roads Congress, held by the Moree Plains Shire Council, a local government agency in the northern area of New South Wales. This forum of nearly 300

delegates, representing both road owners and users, received reports on the status of Australia's rural roads system.

At the Congress we heard a cross-section of road owner groups graphically describe their frustration at being unable to maintain even the most basic level of service, and inability to be able to ensure functional access to rural communities for the purposes of community access and the movement of rural produce and manufactured goods. It's a sad day when we hear of widespread return of sealed roads to their unsealed state due to lack of adequate funding, with the consequential loss of all weather access.

We heard farmers plead for the fundamental ability to freight their hard-won produce out of their properties and to the state and national systems, an ability which is often denied them even after the most minimal rainfall. We heard the freight industry rationally justify material improvements in our roads systems. We heard our country women cry out for access, to be able to safely drive their kids to school, to conduct their farm businesses, to interact with each other, and to go shopping. A break down of access, with both social and economic consequences affecting this, and future, generations!

The Congress demonstrated the view that our national roads system is in crisis, and in serious danger of collapse in the absence of a realistic injection of additional funding. Significant additional funding!

But where does this money come from? Ultimately, it comes from all of us, the road users, the taxpayers. But, there appears to be a disconnect between the source and the outcome, with much of the road user offtake being diverted to other, non-road services.

The solution is not, however, the domain of any one level of Government, but one which demands a unified approach involving federal, state and local governments. On the assumption that additional revenue raising is not a reasonable option, the objective can only be achieved by re-allocation of existing funding toward the roads sector. This requires hard decisions, as with any such reallocation there is always a commensurate reduction in funding, and service, in some other government sector.

It is apparent that the most logical scenario, and one which is both fair and equitable, involves hypothecation of a greater proportion of road user taxes and charges to the road system. The amount of any such hypothecation is debatable, and must be the subject of detailed analysis of the extent of the problem and the time series of investment needed to deliver the most fundamental needs of access and movement to our people and industries.

However, I caution that the cost of data collection and analysis needed to support a rational approach must not be allowed to become a significant cost-burden in its own right. We must not underestimate the costs involved, and the material differences which exist in data definition across this country.

At the same time we are seeing ever increasing pressure on the productivity and cost drivers involved in road construction and maintenance work. Road agencies in Australia, and

across the world, are now confronted with balancing the conflicting pressures of increased demand for construction and maintenance work, the need to minimise traffic delays (and hence less available working time on the road system), the need to minimise social impacts such as the noise impacts of night work, the need to increase the separation between traffic and road workers in order to improve the safety of workers and the public at work sites, and environmental pressures affecting many of our most common road construction and maintenance technologies.

In Australia, these pressures are acting together to significantly drive up the cost of road works, with some estimates suggesting that the underlying real cost has increased by more than 20 percent over the last 5 years purely as a result of these factors.

The case for more money is overwhelming. But, money is not the only solution.

More for Less

The preceding case for more money is based on the premise that the standard of our road system is less than that realistically required to satisfy Australia's social and economic demands, and that money is needed to fund additional works.

Thus, the solution actually involves additional work, and hence a higher level of output of road maintenance and enhancement works. That is, we need to do more widening, safety works, reconstruction, sealing and resurfacing, patching, grading and all types of routine maintenance works.

Hence, the real objective is to do more, produce more.

There are two fundamental ways of doing more work. One involves the injection of additional investment into the system, and using that investment to finance more work. The other involves improving the productivity achieved from our existing investments, thereby increasing the volume of work produced from our current funding.

Neither of these two approaches will, alone, be sufficient to achieve our road system objectives.

Realistically, it is unlikely that federal, state and local governments will be able to re-prioritise their programs to find enough money to fully finance the solution, without the politically unacceptable raising of taxes and charges. Similarly, it is unlikely that there is sufficient scope for productivity improvements of the extent necessary.

Hence, the solution to Australia's road system shortfalls is a strategy under which an increased level of money is invested by governments in road services which are delivered with the highest level of productivity reasonably achievable. Under any other scenario, then some of the money is going toward the production of work, some of the money is going toward inefficiencies from poor productivity, too many resources or poor quality resources, some of the money is going toward ineffective planning and co-ordination, some of the

money is going to rework of work with poor quality, and some of the money is just going toward doing things which aren't required. In simple terms, its hard enough if the bucket is not big enough, or full enough, but even harder when there is some leakage of money from the bucket.

We need more, but we must be able to demonstrate to the decision makers that we can do more with less. Adoption of competitive, market based, procurement processes is generally accepted as being the most objective and proven demonstration of maximum value-for-money.

Competitive Procurement

Competitive procurement is, in its most simple form, market testing and contracting.

It is logical to assume that the competitive market forces which apply in a market testing and tendering environment will determine the lowest cost of achieving a specified output, or outcome. That is, maximisation of productivity. And since maximisation of productivity is one component of the roads solution, it is a means to the end.

But, tendering and contracting are not the only methods available to service procurers to measure the productivity performance of their operations. Benchmarking, and continuous improvement programs, are also recognised as mechanisms of measuring performance and setting improvement benchmarks. However, to be fully effective such programs need to know the best possible productivity performance achievable.

The benchmarking of road maintenance is a complex exercise, demanding great care in the normalisation of the results, as it is one of a number of services for which it is difficult to extrapolate results from one project to others. This fact is valid at both the macro network level, and the micro activity output level.

At the network, or route, level the cost of maintenance is a function of the statistical distribution of a large number of variables, including the pavement type and structure, maintenance history, pavement and surfacing age, traffic profile and history, subgrade type and condition, rainfall, temperature, etc. The probability of a statistically valid sample size of roads with similar characteristics is potentially quite low, with consequential problems of drawing valid conclusions from the comparison of total maintenance costs at a network or route level. It is obvious that the cost of maintaining an old road in poor condition, carrying high volumes of heavy vehicles in a wet environment is always going to be materially greater than that of a new road carrying little traffic in a dry climate.

Similarly, there are a number of variables which have measurable impacts on the unit rate of discrete maintenance activities. These include the distribution of the size of individual occurrences of the activity, the availability of resources and local materials, the density of occurrence and travel distance profiles, traffic control and work hour requirements and the

specification for the works. Again, but to a lesser degree, this makes the comparison of unit rates difficult and inconclusive.

These factors work together to undermine the credibility of road maintenance benchmarking exercises, unless the factors which underpin each result are understood and taken into account. In this regard, we should appreciate that the benchmarking concept was initially developed to measure the performance of repetitive manufacturing processes, where the product, process controls and uniformity of the operating environment are orders of magnitude less variable than the road maintenance industry.

The question remains as to what action a road owner takes when a benchmarking exercise reveals that the cost of maintenance by one agency is greater than that of another. Does it force the level of funding to the higher cost agency down, and therefore remove its ability to deal with an ageing or high demand network, or does it increase the funding of the lower agency, again diverting funds from a potentially more needy agent? Whilst these are extreme examples, they highlight the problems of a sole reliance on benchmarking as a means of productivity improvement in our industry.

I am not advocating that contracting road maintenance is the only, or even right, solution in every case, or that any particular form of contract is the best for every situation. All I can do is point to the evidence, the facts emerging from road maintenance contracting initiatives across the world. And to some of the solutions which have been adopted.

Performance of Different Contract Models

A review of evidence reported from around the world indicates that long term performance based road maintenance contracts are consistently delivering lower costs than any other form of maintenance delivery, and at the same time are generally delivering higher levels of service and a lower level of risk for the road owner. That is, the evidence shows that this form of contract provides the best overall value-for-money for the road owner.

Analysis of the evidence shows that, on average, schedule of rates and combination schedule of rates/lump sum contracts deliver maintenance services at a cost of approximately 20 percent lower than the same services delivered by an in-house workforce. Results of this order, and often higher, are consistently reported by road agencies across the world.

Despite there being a limited number of reported examples of the long term performance based contract model, these contracts are consistently delivering maintenance services at costs of more than 15 percent lower than the schedule of rates type contracts reported above. Examples of the results which have been reported are:

- Sydney, New South Wales 38 percent savings
- Southern Tasmania 20 percent savings
- North Island, New Zealand 15 percent savings
- Virginia, USA 20 percent savings

- South Perth, Western Australia 25 percent savings
- Mid North Region, Western Australia 30 percent savings

It has also been reported that a further six performance contracts in Western Australia have delivered savings of between 15 and 25 percent.

These savings are reported against other forms of maintenance contract, which in themselves have reported average savings of 20 percent against in-house operations. Therefore, the performance based model is consistently delivering savings in excess of 35 percent compared to in-house operations.

The most telling evidence of the improved effectiveness of the performance based model has come from both New Zealand and Western Australia. In New Zealand, road maintenance services were privatised and fully contracted out approximately 10 years ago, and since that time have been through a number of tendering cycles using the more traditional combination contract form. Although each tendering cycle was delivering ever-decreasing savings compared to the previous cycle, costs under these contracts were steadily approaching a stable level. As reported above, a pilot performance based contract achieved an immediate saving of 15 percent, compared to the mature market for the alternate contract format. At the same time, the level-of-service specified was higher than previous, and the amount of risk transfer away from the client road agency was materially greater. Needless to say, the road agency is now increasing the number of performance based contracts.

In Western Australia, the government's initial contracting strategy provided for five performance based contracts and three combination schedule of rates/lump sum contracts. After assessment of the first round of tenders, involving contracts of each type, the government determined that the combination format did not achieve the savings being delivered by the performance based model, and did not satisfy the government's value-for-money objectives. The strategy has been changed by the government, and now incorporates eight performance based contracts.

What are the budget impacts?

Previously, I expressed the view that a saving in the cost of delivery of the services, or operations which deliver more work output from the available funding, have a similar impact on the problem of our road standards as an increase in government funding.

Based on the evidence, the equivalent increase in funding which would result from the theoretical scenario of full use of the schedule of rates contract model across Australia is in the order of US\$0.6 Billion per year. If you break that down to a single road agency, such as a council with a road maintenance budget of US\$0.5 Million per annum, then the effective budget would increase by US\$0.1 Million to US\$0.6 Million.

Similarly, that same Council could theoretically achieve an effective budget increase of US\$175,000 if it could achieve costs routinely delivered by the performance based

contract. On a national level, this scenario would be equivalent to an increase in national funding for maintenance of approximately US\$1 Billion per annum.

These contracting impacts compare the post contract scenario with in-house delivery results. In this regard, ongoing improvements in in-house operations which come from benchmarking and improvement programs will go some way toward a similar result. However, the facts suggest that they do not have the same potential for the sort of savings as are available from a contracting model. Moreover, a large number of our road agencies have already taken up the majority of the savings available from in-house improvement, using pro-active improvement and service delivery reform programs, actually decreasing the effective future budget increases which may come from any further reform.

Whilst I have said that these solutions may not be adaptable to every situation, even a proportionally small take-up of maintenance contracting could go a long way toward funding our current shortfall and backlog.

The Performance Based Contract Model

In simple terms, the performance based contract model is one under which the contractor has almost unlimited discretion to plan, program, design and deliver work output in order to achieve contractually specified performance outcomes. These outcomes are usually defined in “fitness-for-purpose” terms, and aligned with the core objectives of the road agency.

In general terms, road agencies exist to manage the roads and traffic system under their jurisdiction. Whilst the extent of the responsibilities of individual agencies may vary due to statutory differences and government choice, the road agency is generally recognised as the owner and manager of the roads system.

The primary objectives of a roads agency generally include things such as:

- ◇ Reduce total transport costs;
- ◇ Reduce the severity and extent of road crashes;
- ◇ Minimise adverse environmental impacts;
- ◇ Manage the community's investment in its asset portfolio; and
- ◇ Efficiently move people and goods.

These primary objectives reflect the role of a road agency as the manager of the roads system and hence as the client for the provision of those services which deliver the achievement of the objectives. As many road agencies also have responsibility for the provision of at least part of these road services their corporate plans will generally also include secondary objectives relating to the efficient and effective delivery of services and safer and more environmentally acceptable work practices. This distinction between the client (buyer) and road services (seller) roles of road agencies is important to any decision on service delivery methods.

It can be noted from the primary objectives that road maintenance is not an objective of a road agency in its own right. This reflects the fact that the assets being maintained are provided for a purpose which contributes to the organisation's achievement of its primary objectives. For example, a bridge exists to support the efficient movement of people and goods and to minimise transport costs, whereas a warning sign exists to reduce road accident potential.

Hence, and notwithstanding the fact that maintenance is often a significant proportion of a road agency's total budget, road maintenance is an "invisible" function which is undertaken only to ensure that assets continue to satisfy their purpose for existing and continue to contribute to the organisation's broader primary objectives.

Performance based contracts are designed to more closely link the achievement of these functional objectives and the cost of achievement of those standards, removing many of the prescriptive and procedural steps on which more traditional work output based contract types rely. That is, the contracts specify the performance of the road system in terms of asset condition parameters, and of the contractor in terms of management performance parameters, in lieu of specification of work activities, output quantities, cycle times or process description. Moreover, performance based contracts integrate all of the components of the road maintenance task (routine and periodic maintenance, rehabilitation, restoration and replacement) necessary for the management of the achievement of the specified performance outcome.

This shift in the method of specification, from activity prescription to performance, brings about a commensurate shift in the risk exposure of the road agency. In a work output specification environment the client is generally responsible for determining the quantity, type and location of work outputs required to achieve the desired performance levels. As the bulk of the performance achievement risk resides with these decisions the client carries a considerable risk. However, in a performance specification environment the client carries no direct risks arising from these decisions, but will be exposed to a risk premium on service delivery to cover the service provider's increased risk profile. The actual reported savings suggest, however, that this risk premium is not significant, as discussed later in this paper.

The effective allocation of performance risk away from the client is dependent on the service provider having, and maintaining, the skills and experience to turn the performance specification into a work output plan. Traditionally, this skill and experience has predominated in road agencies. To be fully effective, therefore, the establishment and maintenance of these skills outside of the road agencies needs to be encouraged and nurtured as part of the contracting strategy.

Asset performance is generally described in two separate, yet inter-dependent, ways. Firstly, the day-to-day duty of care of a road agency to ensure the road assets are free of defects which are unsafe or dysfunctional is specified in terms of Intervention Standards. These standards usually take the form of defect severity levels which must not be exceeded, and response times which prescribe the time latitude given to the contractor to adequately

respond to identified defects. Secondly, the contracts define several measures of overall asset condition, with a strong emphasis toward pavement conditions. Annual targets for roughness, rutting, cracking, texture, skid resistance and strength are commonly used.

Network and system management performance is usually specified in terms of target times for public response, and compliance with the contract requirements and various key elements of the contractor's project systems. Targets for compliance with occupational health and safety, environmental management, traffic management, emergency response and maintenance plans are often specified.

Performance based contracts do not specify the methods, materials, processes and programmes to be employed by the contractor in the achievement of the specified performance objectives. However, the most recent Western Australian contracts have mandated the road agency's existing procedures as the minimum to be employed, and allowed the contractor the latitude to improve those procedures over time.

Why are they cheaper?

Many observers question the apparent paradox, that contracts with larger scopes, longer terms, and greater risk transfer come at lower cost to the road owner than smaller, low risk, short term, schedule of rates contracts. The answer lies in the degree of control exerted by the owner, and the reduction in risk arising from broader scope and longer term.

A more fundamental question though, is why contractors seem to consistently deliver maintenance works at a lower cost than an in-house workforce, despite the risk transfer issues. Observers have often put this down to a perception that worker remuneration packages are less than those paid by government (which in itself is a paradoxical perception, as higher private sector wages are often quoted as a reason why workers leave government employment), the perception that the price of non-labour inputs are lower, and the perception that contractor's are taking losses to "buy" contracts in order to promote future growth of the market.

There is no evidence that remuneration in the private sector is less than that in the public sector. In fact, most wage agreements and awards are actually based on the relevant government award, and more often than not enhanced by attractive benefits and gain-share schemes. Moreover, my analysis indicates that a given physical resource, if well managed, will produce roughly the same quantum of output, irrespective of whether it is employed by the public or private sector.

Similarly, there is often little difference in the supply procurement arrangements used in the public and private sectors. Both sectors generally use value-for-money competitive processes to select suppliers, with value being heavily biased toward consistent quality and price. In fact, with most government contracts now obligating compliance with central government Codes of Tendering and Practice, any historical difference in behaviour has all but vanished.

The concept of companies in the current construction industry market in Australia buying long term risk contracts at loss-leading prices, or at prices which do not provide shareholder returns commensurate with other investments, is absurd. No company is going to commit itself to that situation for the next two years, five years or ten years.

It is my view that the main cost differences come from one basic difference in the primary objectives of the management teams in the two types of organisation. Whilst managers in both the public and private sectors are equally committed to quality, to cost-effective maintenance work and to professional management, their response to budget influences are vastly different. In the private sector the manager is driven by a clear performance objective of making money for the shareholders, which means delivering contract obligations at the lowest financial cost. In long term contracts, this means at the lowest long term cost. Managers are rewarded for achieving savings against budget. However, public sector managers are encouraged to spend their budgets each year, to “spend it or lose it”. This is frequently evidenced by road agencies rolling out previously unprogrammed works at the end of the financial year, sometimes poorly designed, and sometimes undertaken under the wrong weather conditions.

Back to the leading question, of why performance based contracts are more cost-effective than schedule of rates contracts.

When pricing a schedule of rates the contractor has to make assumptions regarding the scheduling of the work, and hence has to assume that it will be given small quantities at a time, and hence be unproductive. They have to adopt sometimes prohibitive prescriptive specifications, which preclude the best engineering solution. Where a lump sum component is concerned, they have to assume that the road agency may cut-back their preventative programs, and leave the contractor with an increasing burden of reactive repair work.

The more interfaces, the more chances for breakdown in efficiency and co-ordination, and hence the higher the cost. A summary of the differences between these contract formats is provided in the attachment to this paper.

Increasing scope is also a risk limiting factor. A wide scope, including pavements, shoulders, signs, lines grass etc generates a broader risk profile and hence limits the overall risk. It is similar to investing in the share market, where analysts try to spread the risk over as many sectors as possible.

Similarly, as the length of the network increases the prediction of future performance becomes less of a detailed technical prediction, and more of a statistical exercise. I would challenge anyone to predict the roughness of a single 100 metre road section in ten years time. However, I am sure than an experienced person could reasonably accurately predict the average roughness of 2000 kilometres of road. This predictability is due in part to the inertia created by the sample size, and in part due to most behavioural models being based on actual network level performance monitoring.

A longer term also limits risk, as it materially reduces the impact of short term weather patterns in the predictive exercise. Take Sydney as a classic example. The cost of road maintenance four years ago, in the middle of the El-Nino (a prolonged period of abnormally low rainfall), was significantly lower than it is today, where we are experiencing ongoing rainfall periods. What pattern do you assume if your are pricing a two or three year lump sum?

Risky?

There is a common perception that long term maintenance contracts are filled with risk. I do not believe that this perception is accurate or that it stands up to a reasonable degree of scrutiny.

Yes, there are risks, and some of them are significant. But, in general, these major risks are manageable, particularly over the longer term. A sound management regime, with extensive ongoing monitoring and audit, provides the contractor with a regular update on performance, and hence with the early warning signals of over or under performance trends. This allows the contractor to plan for, and implement, corrective action and to explore innovations which can act to remedy the trend. Moreover, the long term partnership aspects of these contracts create an environment where the contractor and road agency can work together to resolve emerging issues, to the long term benefit of both organisations.

Similarly, the client road agency is exposed to no greater risk under this form of contract. Firstly, it has effectively contracted out its future performance prediction, weather, traffic and technology risks. Secondly, it has unbundled contract payment and budget from the flow of work outputs, thereby allowing unconstrained delivery of the least long term cost solution. Some would say, however, that the agency has inherited a new risk, the failure of the contractor to perform the contract obligations, or of the contractor "going bust". Providing both contractor and client have established sensible early warning signs, the only additional risk of the client is the risk of procurement of a new supplier. Normally, the benefits accrued by the time any such event was to occur would more than offset this risk.

Whilst risk, and risk management, is an inherent element of these contracts, so is opportunity. No other form of contract can create the incentives for innovation, best practice and continuous improvement generated by long term performance based contracts. Realised opportunities cancel out risk, or generate improved returns for the contractor. Some contracts provide for any such additional returns to be shared with the road agency. Shorter term contracts, and those with traditional prescriptive activity and material specifications, may actually discourage innovation through their short pay-back period, complexity of technology accreditation, and the risk of loss of competitive advantage.

Hence, long term performance based contracts, if properly designed and managed, provide real opportunities for the advancement of road engineering practice.

Engineering, technology and innovation

In the previous section I highlighted the commercial imperative for long term performance based maintenance contractors to continually explore and adopt innovative practices as an integral part of their risk management regime.

Under long term performance contracts the contractor is encouraged, and often obligated, to be innovative. Traditional barriers to the introduction of new processes and technologies are lifted, and the risk of the process clearly assigned to the contractor. Unfortunately, these same barriers have proven to be an effective inhibitor of innovation in Australia, which in my view now lags behind the international industry in terms of its adoption of improved technologies.

Anyone who has tried to have a new technology accepted as an accredited process by a road agency will recognise the industry's frustration. Despite the commitment of sometimes significant investment into the research and development of a new or improved process, or the import of a proven overseas process, most road agencies demonstrate inertia in its acceptance. Usually, the process is trialed, often on short lengths of road unsuitable for the technology itself, the trial is sometimes monitored, reports written and sometimes adopted. At the same time, the road agencies often demand in-depth technical specification of the process, sometimes critical of its difference to their normal paradigms of road technology. It's different, so it's bad! And then, if it works, and assuming that the process has not taken so long that the technology itself is no longer redundant or "old-news", we often see an attempt to discharge the intellectual and commercial property inherent in the innovation by writing detailed specifications for it.

This is normally the process a maintenance contractor must go through in order to have an innovation incorporated into a traditional short-term prescriptive maintenance contract. That is, a process of specifying the process and the output, irrespective of the road condition objectives of the parties.

Such processes, and the "not-invented-here" barriers which are often inherent in them, do not apply in performance based contracts where the contractor has the latitude to take the risk of application of technologies which may improve the cost-effectiveness of achievement of the required road condition outcomes.

A related issue, and one of concern to the engineering fraternity, is the potential loss of engineering skills in the road sector, and the long term effect on the ability of our industry to be an informed client and a skilled service provider.

We have witnessed a trend over recent years of loss of engineering and technology skills from central road agencies. Whilst the reasons for this trend are outside the scope of this discussion, it has been paralleled by an increased focus on government as a buyer of services, and general reductions in government investment in research and technology. In

the road sector, this trend appears to have been independent of any contracting out, suggesting that it is likely to continue irrespective of contracting strategies.

The Australian private sector is keen to take up this loss, and to further skill itself to perform a far greater range of engineering services than were traditionally required. But, this cannot be done in the absence of commercial incentives in the form of commitment to the availability of ongoing work opportunities for those resources. Contracts need to be big enough, broad enough, and long enough to allow a contractor to make a decision to employ more people and to guarantee their long term engagement. For example, no contractor is able to engage an experienced road engineer for a 2 year contract valued at only US\$0.25M per year.

Implementation matters!

Notwithstanding these results, and the evidence, the adoption of competitive procurement of road maintenance work in Australia has been painstakingly slow. Latest estimates are that over the past 5 years we have put less than 5% of the national road maintenance work to competition.

The inertia which road agencies and policy makers have shown appears to reflect a perceived social downside to what is often thought to be economic rationalism and privatisation at work. Arguments focused on the loss of jobs, particularly in rural and regional centres, loss of expertise and local knowledge, and loss of control, are common. These are real issues, and warrant full and proper consideration in the development of any improvement program. However, in my view, the Australian road industry needs to carefully approach these issues from a balanced perspective, and to properly consider the benefits and disbenefits of all candidate strategies, including the long term consequences of our current situation.

At the outset, we must seek to understand the different consequences of contracting out of road maintenance and the more widely debated privatisation of government services. Much of the privatisation debate has focused on the loss of levels of service in regional areas, driven by commercial return on investment decisions which do not favour high cost services in low density, and hence return, areas. The privatisation of banks, telecommunications and other government services has also seen massive centralisation and rationalisation, with commensurate loss of employment in regional areas.

There are stark differences between this form of privatisation and the contracting of the road maintenance task. Firstly, the form of contract which I am advocating, the performance based model, clearly and objectively establishes levels of service which, when enforced by the financial sanctions in these contracts, effectively guarantee the level of service which will be delivered at all times. Enforceable guarantees of road condition, of timely response to defects, complaints and emergency situations, and with health, safety and environmental requirements, and the unbundling of these guarantees from government and agency budget constraints, are unique to this form of contract. In this regard, it should be noted that all performance based contracts to date have specified the short term removal of any backlog

of maintenance work, and a material improvement in the short and long term level of service provided. Hence, the community will get improved standards and improved levels of service, enforceable through the contracts.

Secondly, and more importantly, the actual task of managing and maintaining a road network cannot be centralised or moved away from the local area. Maintenance is about work, inspections, defect identification, planning, repair, monitoring and reporting. These activities can only be delivered through a locally based resource team. After all, whilst it is possible to centralise a call-centre for telephone or banking services, it is not possible to centralise all of the potholes in a regional network into one central location for repair and return to the client. Because the work stays with the road, the resources also must stay with the road, and hence the expenditure of the maintenance service provider must largely stay with the network. Thus, local jobs and regional economies are supported and maintained, now and into the future.

Another argument has been the loss of local experience, knowledge, skills and expertise. Given the risks involved, and the contractual demand for a contractor to quickly mobilise a maintenance service, it is difficult to believe that a contractor would not do everything possible to assimilate as much of the local knowledge and skill available into the maintenance organisation. Why would a sensible contractor bring in outside resources with no local knowledge of the network, available materials, community demands and people, and try to teach them these things, when a pool of established workers, suppliers and subcontractors are readily available? The continuation of local employment and maintenance of a competitive local supply of resources and subcontractors is not only efficient and cost effective, but a commercial imperative.

In all of my research I have yet to see a road maintenance contract under which the contractor did not do everything possible to retain the existing local knowledge and employment.

The most critical issue is therefore the impact of contracting on the number of jobs and the impact on regional economies. No one wants to see local employment decimated, local businesses being forced to close, or communities evaporating. Hence, the trick is to protect those economies, and if possible, to support long term sustainable growth.

This is possible. As I have said, the aim is to generate more work, and hence release previously inefficient resources for the purposes of improving road standards. Re-investment of the released funds into these improvements in turn generates more work, and hence jobs. Hence, assuming that savings are reinvested in the road system, the sum total effect of contracting on jobs is reduced, but not eliminated.

As in all other industries, ongoing improvements in technology and productivity are going to have a negative impact on jobs. Similarly, the adoption of a benchmarking/improvement program for road maintenance service delivery, in lieu of contracting out, will result in a loss of jobs. Since road maintenance is relatively labour intensive, it should hold that two

organisations (say public and private) delivering the services at the same cost will require the same number of people. So, at the end of the day, the result will be little different. Of course, this does not apply where policy constraints inhibit the adoption of more productive practices, and hence where unchanging resource levels dictate the level of productivity and effectively divert much-needed road funding to employment programs.

But the situation is not all that bleak, solutions are possible. There are examples of contractors assuming the management and control of a road agency's people and engineering assets, and delivering up to 20 percent more work output by adopting private sector management techniques. That is, delivering an effective increase of 20% in the maintenance budget. More output, no jobs lost.

Another proven approach is to use the contract to mandate regional development. The contract can require the retention of employees and hence experience and knowledge. It can specify minimum levels of investment in local communities, sponsorship of local students and graduates, information exchange. The list goes on. These concepts have been successfully implemented in recent contracts in Western Australia, following consultation between government and industry.

So what is the real solution? In my view, it lies in a mutual understanding of the needs of road agencies, political representatives, communities and the private sector. It lies in a spirit of consultation and communication, and an openness to consideration of a whole new range of partnering opportunities.

The private sector has tremendous capacity, and the commercial incentives, to seek out workable solutions to current and emerging road system problems. To do this most effectively we need to break some of the traditional rules of procurement, whilst maintaining utmost concentration on probity, and ensuring value for money. For example, you would appreciate our reluctance to put forward the proposition for management of a road agency's resources where the agency was forced to document our concept and seek tenders from other suppliers for the same thing.

There are many other solutions which I have not canvassed. The challenge is for the public and private sector road industries to work as one to explore, try and adopt solutions which deliver the right outcome, without compromising the important issue of demonstrating value for money.

The real question is, can we afford not to?

Revolution, not evolution!

In this paper I have sought to highlight the critical importance of more cost effective road maintenance practices to the achievement of a safe and serviceable Australian road system for the future.

My discussion has highlighted current evidence which consistently points to the adoption of properly designed and implemented road maintenance contracting strategies as a key element of the achievement of more cost effective road maintenance practices, and the potential for longer term performance based contracts to drive optimal performance. At the same time I have sought to canvas a number of perceptions of maintenance contracting, and to place those perceptions in the context of the overall objective of better roads.

Put simply, I am saying that the time has come for hard decisions. We need more money, and we need to be able to demonstrate that our funders, the taxpayers and governments, are truly getting the best possible “bang for their buck”.

Critics will call for caution, for a slow process of evolutionary change, controlled by central road agencies. They will look for more of the same, with small incremental changes which have minimal effect on themselves and their organisations.

But look carefully at the evidence, and separate perceptions from fact. Under the slow process of evolutionary change we have actually achieved very little. How much real difference is there in the methods, materials, and processes used in the asset management and maintenance of our road network ten years ago to those used today? Not much!

If we extrapolate the current evolution into the future, we are exposed to the real risk of collapse of functionality of our road system, or an ever increasing need for greater levels of investment. This realisation can be avoided through a fundamental revolution in the way we manage and deliver our road maintenance, in conjunction with budgetary reform.

I am advocating that we recognise the need for this revolution now, and work together as an industry to identify and manage solutions to the inherent issues. Surely, proactive management of future changes in our operating environment is the superior course.

References

1. Road Facts '96, Austroads, Sydney, 1997
2. Austroads website, March 2000
3. “Successful, Cost Effective Road Maintenance Practices”, Frost, Australian Road Federation Roads 2000 Congress, Sydney, Australia, March 2000.
4. “Regional Issues in Maintenance Contracting”, Frost, National Rural Roads Congress, Moree, March 2000.
5. “Experience with Maintenance Concessions in Australia”, Frost and Odams, Road Management and Finance Workshop, Port Moresby, February 2000.

6. "Developments in Specifications and Contractual Arrangements: Towards Performance Contracting", Gallagher, 1st International Conference, World of Pavements, Sydney February 2000.
7. "International Best Practice in Road Maintenance Service Delivery", Frost and Allen, Saudi ARAMCO, Riyadh and Dhahran, May 1999.
8. "Long term maintenance contracting: A solutions based analysis", Lithgow and Frost, Roads 99 Conference, Sydney, March 1999.
9. "Effective Road Maintenance Contracting", Frost and Lithgow, Road and Rail Infrastructure in Australia Conference, Sydney May 1998.
10. "Performance Specifications – Past, Present and Future", Frost, AAPA Conference, Perth, November 1997.
11. "Establishing and Efficient Road Management and Maintenance System", Frost, Commercial Asset Management in Rail and Road Conference, Sydney, August 1997
12. "Improving Quality and Cutting Costs through Performance Contracts: Australian Experience", Frost and Lithgow, World Bank Road Management Seminar, Washington DC, December 1996.
13. "Road Maintenance Contract Experience in New South Wales", Frost and Lithgow, Maintenance Engineering Society Symposium, Newcastle, June 1995. (Also presented at Austroads conference, Melbourne, September 1994)
14. "Using Service Level Agreements to Improve Road Maintenance Performance", Morris and Frost, Service Level Agreements in Outsourcing Conference, Sydney, July 1994.
15. "Findings of a Pilot Study of Road Maintenance Contracting in New South Wales", Smith, Frost and Foster, 3rd International Conference on managing Pavements, San Antonio, May 1994 (also presented at 17th ARRB Conference)
16. "Maintenance by Contract: A Contractor's Perspective", Erwin, April 1994
17. "Pilot Road Maintenance Contract Project", Frost, Australian Earthmovers & Contractor's Federation National Conference, May 1993.

Issue	Demonstrated Benefits of the PBC Format	Comment on Alternate Formats
Savings from PBC contracts are greater than those from other forms of delivery and contracts.	All current PBC contracts have delivered savings when compared to alternates.	<p>Savings arise from the ability of the contractor to plan and co-ordinate the routine, periodic and rehabilitation works to achieve the lowest long term cost.</p> <p>Contractors are forced to assign higher unit rates to works due to doubts about the programming of works under the control of the agency (eg resurfacing), which have a material impact on the quantity of routine maintenance works.</p> <p>For example, a delay in resealing by the agency increases the quantity of pavement repair work. Contractors are forced to factor this risk into the price.</p>
The condition of the road assets is improved	All current PBC contracts have provided for a contractually guaranteed improvement in the short and long term condition of the roads.	Improvements are not achievable in routine contract formats as the contractor cannot control the elements of the program (periodic and rehabilitation) which drive changes in condition.
Supervision costs are reduced.	PBC contracts only require routine supervision to audit and validate that the specified road condition levels have been achieved. Supervision of work quality is not required.	Other contract formats require audit of compliance with work quality, which is more time consuming and costly. Approval processes for schedule of rates work is also time consuming and costly for both parties.
Road condition standards are contractually guaranteed	The contract deals with the achievement of specified standards of road condition, and not the quality or extent of the maintenance works.	Other contract forms rely on empirical relationships which seek to link work output and quality to achieved road condition. The risk of this relationship lies totally with the road agency.

Issue	Demonstrated Benefits of the PBC Format	Comment on Alternate Formats
Budgetary certainty is achieved	<p>Current PBC contracts incorporate a fixed 10 year payment schedule for the achievement of the specified condition.</p> <p>The contractor assumes the risk of achieving the required standards for the payment of the fixed amount.</p>	Other contract formats do not provide any budgetary surety, as the agency controls the allocation of work and budgets against the schedule of rates items.
Transaction costs are reduced	The long term of the contracts reduces the overall long term cost to both the industry and the agency, provided a limited number of tenderers are registered. Four tenderers have been used in all current contracts	<p>The shorter term contracts require repeat effort by tenderers each contract cycle, increasing overall cost.</p> <p>The low value of the contracts ,mean that the proportion of the transaction costs are a higher proportion of the contract costs.</p>
A higher quality of management is achievable.	PBC contracts allow for the engagement of specialist project and maintenance management staff, and the implementation of a regime of specialist support in the areas of traffic management, environment and pavement planning	<p>The size and scope of routine maintenance contracts do not allow for any specialised staff.</p> <p>The cost of a dedicated project manager would be a significant proportion of any contract cost.</p>
The road agencies risks are reduced	The contractor assumes all of the risks associated with the achievement of the specified standards. These include risks of traffic growth, weather risks, a significant part of the natural disaster risk, and future workload and price forecasting risk	<p>Only routine quantity and price risks are transferred to the contractor. The contractor does not take risk of future road conditions</p> <p>The agency retains all of the material risks, including those relating to the major resurfacing and rehabilitation components and routine maintenance quantities</p> <p>Contractor risks are increased by the creation of interfaces between elements of the program under contractor control and those under agency control, increasing contract costs.</p>

Issue	Demonstrated Benefits of the PBC Format	Comment on Alternate Formats
Contracts are administratively simple	PBC contracts are specially designed for the type of services included, and the mechanisms of administration. Documentation is becoming standardised as experience grows.	Generally, other contracts seek to utilise standard engineering construction contract formats, which are not always suitable for maintenance type activity. Schedule of rates approval mechanisms are complex and costly.
Innovation in materials and processes is achieved	Contractors have a commercial imperative to seek out continuous improvements and best practice delivery methods. Opportunities for savings offset potential downside risks. Contractors assume the risk of the introduction of new technologies and processes.	The high degree of work specification inhibits for innovation, as it demands compliance with agency specifications. Road agencies bear the majority of any innovation risks.
Employment opportunities are improved	The scope and term of the PBC contracts allows contractors to engage people in surety of their ongoing utilisation. The scope of the contract allows contractors to engage experienced people and ensure knowledge and skill are maintained in the local area.	The size and short term of alternate contract formats does not lend itself to large scale recruitment.
Minimum whole-of-life cost is achieved.	An inherent feature of the PBC is the achievement of the lowest cost (through competitive and commercial pressure) to achieve the desired standards over a long term. Contractors plan the works to minimise the cost and maximise the return, in terms of achievement of improved road conditions.	Other contracts only minimise the cost of the routine maintenance component, and have no bearing on the cost of the entire maintenance system. The cost of poor industry asset utilisation inherent in current road agency short term procurement plans are maintained, increasing the overall maintenance cost.

Issue	Demonstrated Benefits of the PBC Format	Comment on Alternate Formats
Overall industry utilisation is improved	The PBC allows the industry to plan its future workload, and innovation effort, to ensure that its human and physical assets are utilised to the maximum extent possible.	Utilisation of the high cost elements of the industry, pavement and surfacing assets, is not improved by other contract formats. Utilisation remains at very low levels due to poor, short term, planning by road agencies, increasing the cost of these services.
Agency control is diminished	<p>The location and timing of maintenance works is controlled by the contractor. Additional works are treated as variations, although rescheduling can be readily accommodated.</p> <p>Annual programs are “locked-in” and co-ordinated with government budgeting and publicity cycles.</p>	The agency retains all control over the timing and design of works.
A single public focus on road condition and maintenance accountability is achieved.	Contractors assume responsibility for responding to public complaints etc, and engage specialist resources to deal with the public.	<p>Limited overall responsibility generates the “not my problem” scenario, where the contractor can readily deflect complaints to the government agency.</p> <p>Contractors limited management resource does not provide for specialist public relations service.</p>

The Author

Malcolm Frost

National Manager, Road Management Division

CSR Emoleum Road Services

&

New South Wales Convenor

Australian Road Federation

Malcolm Frost is recognised as a leading expert in the field of performance based road maintenance and contracting. He is regularly invited to present on these topics at forums in Australia and overseas.

Malcolm is a professional engineer with more than 20 years experience in all aspects of road planning, management and maintenance.

Malcolm worked for the New South Wales Roads and Traffic Authority (Australia) in various road asset management and maintenance roles over a career of 20 years. Until 1997, Malcolm was the General Manager, Infrastructure Maintenance and was accountable for policy, strategy and programming of the management and maintenance of the entire road network.

During this period, Malcolm was accredited with development of what is recognised to be the world's first fully performance specified road maintenance contract.

Since 1997 Malcolm has been the General Manager of the Road Management Division of CSR Emoleum Road Services, Australia's largest specialist road services organisation. This Division is also Australia's largest road asset management and maintenance contractor.

Malcolm Frost brings a unique mix of experience as both public sector client, and private sector client, which provides a unique insight into many aspects of this important topic.