
OPEN ROADS
DETERRENT OR BENEFIT

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Acknowledgements

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Published

First published in New Zealand in 2005 by
Development Industries Limited
P.O. Box 302 074
North Harbour Postal Centre
Auckland

Telephone: +64 (21) 0236 0226

Printed

Development Industries Limited
P.O. Box 302 074
North Harbour Postal Centre
Auckland

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ISBN 0-473-11108-X

Preface

This submission has been prepared in response to the request for submissions to the *Tackling Congestion in Auckland* (MoT, 2006[1]), a study released by the Ministry of Transport of the New Zealand Government in March 2006. The Ministry of Transport proposes charging motorists for road use in the central area of New Zealand's largest city, Auckland, through one of five scenarios, which include passing one or two cordons surrounding central Auckland, driving in central Auckland, using the motorway or using parking in congested locations.

The information contained in this document is consistent with, and has been largely provided already, in response to earlier request for information from the New Zealand Government in 1998, 2001 and 2004. However, as we recognise that the rapid turnover of people in the government agencies leads to rather short institutional memory, we have restated our position in relation to the *Tackling Congestion in Auckland* submission process as confirmation of our continued commitment to innovation in roading and our longevity in the industry segment.

This document considers the charging of roading in a number of parts : (1) we identify the areas where the report fails to fully consider the requirements of roading services; (2) we illustrate some of the policy outcomes if the proposed roading pricing system was introduced in the proposed format; (3) we consider the requirements of an alternative, taking into account the strengths and weaknesses of the current proposed road pricing system; (4) we propose a fix to the problem, drawing upon superior technological, organisational and economic elements to provide a solution that eliminates weaknesses with the selection of a road pricing system while preserving the strengths of such a system; (6) we examine the impact of the proposed fix on the bigger picture; and (7) we highlight the challenge facing the New Zealand Government and the Ministry of Transport in particular.

We have also released this information to the wider audience of interested groups in New Zealand to lift the level of understanding of the issues at stake and the options available. Copies of this information have been and will be provided to select local government authorities to inform them of impending changes in their planning horizons.

We welcome feedback on the issues contained within this document and the constructive cooperation of all parties in creating a better roading environment in New Zealand and the improvement of New Zealand's economic future.

[1] Ministry of Transport [MoT]. (2006). Tackling Congestion in Auckland: Auckland Road pricing Evaluation Study. Available [online]: www.mot.govt.nz. [17 March, 2006].

Contents

Part 1 - The Report Failures

Introduction

This part of the document first considers the Theory of Road Pricing and its enabling technology, and draws the conclusion that the MoT report has failed to take account of available options. Second, the methodology used by the MoT report to select technology is considered and the claim is made the political risk aversion dominates the reasoning behind the technological design. Third, the assumption of the public model for operating the service is exposed and its weaknesses are commented upon. Fourth, a comparison is made with an alternative scenario encompassing the declared preference for full network charging, combined with lower capital and operational costs. Fifth, the public acceptability of the project is noted and comments regarding the emphasis on political spin and legal measures instead of superior economic performance noted. Sixth, the comparison with other schemes is noted and some comments made regarding the actual situation in the United Kingdom rather than the stated reasoning. Finally, the futility of the submission process is noted and it is pointed out that public accountability for poor decision-making rests with everyone involved in this process.

Theory of Road Pricing/Enabling Technology

The report (MoT, 2006[2]) recognises that "the best method of dealing with [congestion] is by charging each road user for their use of the road according to the extra cost to society that their use imposes" (p. 6).

However, the concept of charging users on their actual road use has been dismissed by the claim that "it is still technically difficult to track individual vehicle movements across the city's entire roading network" (p.7). Indeed, the report goes further claiming the "enabling technology for Full Network Charging is not yet developed".

This claim is wrong.

Further, at least one of the members of the Official's Steering Committee (OSC) responsible for releasing the MoT report knows, or should know, that this claim is wrong.

A full overview[3] of a proposed road information system was supplied to the New Zealand Government in response to the 1997-8 Roading Advisory Group review of the roading system. It was noted at the time that the technology to enable the proposed capability would be available in four years.

In response to Transit New Zealand's request for public information on Road Tolling technologies in 2001[4] and again in 2004[5], Transit New Zealand was advised first of the pending availability and then of the availability, respectively, of the enabling technology. Transit has chosen to continually ignore this technological option for its own reasons.

In addition, Transit New Zealand has a legally defined organisational objective of a sustainable land transport system as its organisational objective[6]. The definition of sustainable means 'keep going continuously'[7] and therefore Transit New Zealand is obliged to ensure no nett economic detriment, as such long-term economic loss would ensure that capital cannot be renewed when it reaches its end of life, and thus is unsustainable. Transit's support of and collaboration with the MoT report, which recognises a small economic loss on Auckland, can be considered unlawful. Transit New Zealand's role in the MoT report is more curious when one considers that it has been aware for years of a roading option with nett positive economic impact has been available.

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[2] Ministry of Transport [MoT]. (2006). Tackling Congestion in Auckland: Auckland Road pricing Evaluation Study. Available [online]: www.mot.govt.nz. [17 March, 2006].
[3] Obren, Mark P. (1997). *Open Roads: Monopoly or Utility*. Auckland, New Zealand: Blacktop Services.
[4] Transit New Zealand. (2001). *Telecommunications using the State Highway Network.* Wellington*:* Transit NZ.
[5] Transit New Zealand. (2004). Toll Systems Project. Available [online]: www.transit.govt.nz. [September 2004].
[6] s. 77(1) Land Transport Management Act 2003.
[7] Oxford. (1978). *The Oxford Concise Dictionary, sixth edition, ed. Sykes, J.B.*. Oxford, United Kingdom: Oxford University Press.

Further, Treasury and Ministry of Transport both have had copies of the submissions in their internal libraries. It is reasonable to expect that members of the OSC from these organisations would have researched prior work in the field as part of their preparation for their OSC role. In addition, the ongoing work on roading infrastructure systems is known to TradeNZ as part of New Zealand's technology export development.

If one takes into account information available to the New Zealand Government, an accurate representation of the situation regarding the technology to enable a user-pays style regime for roading services becomes:

1. The technology exists and is currently in limited scale manufacture.
2. The technology has been developed in Auckland.
3. The technology will be introduced into a foreign roading network in 2006.
4. The technology will be in widespread deployment in New Zealand and other countries by the time the proposed road pricing scheme will be introduced.
5. The technology has significantly better economics than the less capable technology proposed by the report.
6. The New Zealand Government is disinterested in the enabling technology and available services for its own reasons.
7. The New Zealand Government's action in supporting this report is probably unlawful.

Therefore, the MoT report is based upon an inaccurate representation of the real situation.

Technology Selection - Risk Aversion

The MoT report[8] gives the primary reasons for the technology choice as:

- "Provides for charge collection under free-flow conditions
- Is proven technology
- Provides a low operating cost compared with other options
- Provides payment methods for infrequent users" (p. 14).

A secondary reason given is that "the choice is aligned with the technologies and processes currently being developed for the Toll Systems Project (TSP) by Transit NZ and Land Transport NZ" (p. 14).

However, a tolling system based upon the technologies referred to in *Open Roads* would prove an interesting alternative compared to the preferred solution. Such a service would also provide for charge collection under free-flow conditions and provide payment options for infrequent users. Such a service would provide a lower operating cost than the preferred DSRC (Dedicated Short Range Communications) solution.

The sole remaining issue arising from the four primary reasons stated above is whether the solution is a proven technology. So, what is a proven technology? The report recommends building a back-office system to handle the billing and payment functions. Software would need to be developed to interface with the data collectors. Indeed, the admission that such a system is being developed by Transit NZ and Land Transport NZ is tantamount to an admission that the solution is ***NOT*** proven technology, as it is still under development! Thus, the report's recommended solution represents a higher risk in reality as a consequence of its earlier stage of development.

Further, why do other countries find it acceptable to implement new technology solutions and not New Zealand? What is different about New Zealand that makes the New Zealand Government unable to undertake new technological programmes that are acceptable elsewhere? The New Zealand technology industry is certainly capable, and hence the reason must lie within the Government. Why would a New Zealand Government agency or group not buy a local product with superior economics and a lower risk profile? The answer is simple.

Buying New Zealand technology is a *political risk* which no New Zealand government agency is prepared to undertake. Buying *foreign* products provides a convenient scapegoat in case of failure. As a result, in practice it is almost impossible for a New Zealand private sector firm to sell Information and Communications Technology (ICT) to the New Zealand Government. In fact, any honest survey of the Government ICT infrastructure would show the depth of the Government's failure in its role as a customer of New Zealand ICT.

Thus, when the MoT report refers to the benefits of proven technology, it really means *lower political risk* and it should be read in this light.

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[8] Ministry of Transport [MoT]. (2006). Tackling Congestion in Auckland: Auckland Road pricing Evaluation Study. Available [online]: www.mot.govt.nz. [17 March, 2006].

Public Sector Model Assumption

The report is remarkably silent on one key aspect – the organisational design of the body tasked with operating the service.

However, when one takes into account the stakeholders of the project, then the public sector slant becomes clear. One of the key members of the OSC, Transit New Zealand, has already proclaimed a public sector bias in tolling services, stating in *Toll Systems Project*[9] that it saw the role of the private sector in road tolling as restricted to those "aspects of the work that are not core business" (p. 08).

Yet, there is no justification of this position in the document. The general assumption of the superiority of the public sector model precludes the input of the private sector into the road management issue, while the well-known and entrenched New Zealand Government bias against New Zealand technology in favour of foreign technology ensures a barrier against the consideration of domestic capabilities.

In fact, there is much international research and experience in New Zealand that suggest that the public sector model would provide an inferior approach to a partnership with the private sector. The public sector is renowned for its risk aversion, placing of political considerations before economic performance and lack of innovation. The domination of the government as key stakeholder precludes effective governance control by the motorist, as toll management is highly unlikely to dominate any electoral contest and thus there is no significant political restraint upon tolling services. In practice, the effectiveness of regulation and control by contract of a public body is inferior to a private sector body, as the New Zealand Government tends to fail to respect the conflict of interest between ownership and governance, and inevitably places its revenue requirements above governance roles in the long term. Over time the public sector would increasingly come to perceive motorists as revenue targets, and place the emphasis on enforcement rather than focussing upon innovation to grow revenues and enhance value to customers.

The lack of consideration of the alternative forms of organisational design is a failure of the report driven in all likelihood by political factors. There is certainly the depth of advice available to incorporate this issue, with NZIER and Massey University both able to provide such analysis. This limitation by itself limits the report validity in an economic context by ignoring alternative, and in all likelihood superior, options.

[9] Transit New Zealand. (2004). Toll Systems Project. Available [online]: www.transit.govt.nz. [September 2004].

Public Acceptability

The report focus on public acceptability highlights a number of issues that underpin the report.

It is acknowledged that Aucklanders perceive a failure to plan for the big picture, are sceptical of inaction and the misuse of resources in pursuit of other public sector objectives, and that a significant degree of scepticism exists.

The answer, according to the report, is a combination of spin and law.

There is an alternative. The scepticism is well-founded and the current report is in fact a continuation of government inability to perceive 'the big picture', continuing misuse of resources to fulfil public sector objectives and will act as a reinforcement of the very scepticism that the spin and legal options are attempting to control.

The supporters of the report will of course claim that the proposed roading network represents action and an improvement upon the situation. However, when one considers that the report fails to recognise the significant economic benefits to the New Zealand motorist that are foregone by the framework adopted, then it is apparent that the report attempts to fix a problem in isolation from the general development of the economy. The opportunity cost of the alternatives has been ignored.

The result is inevitably an expensive solution with marginal benefits that will be overtaken by other developments in the New Zealand and world economies.

Privacy

The 'big brother' issue is alluded to in the report. It is interesting to note that there is a belief that 'privacy is becoming less of an issue for today's population', due to the multiplicity of ways people are tracked.

Surely the increasing level of tracking requires greater attention on protection of individual privacy and not less. Where are the safeguards to prevent use of the data for purposes other than road billing? The New Zealand Privacy Act 1993 provides more for a process for Government to enable data matching than to protect individuals from any extension of Government scrutiny perceived in the interests of the public sector.

Comparison with other Schemes

United Kingdom

The scheme in Leicester is considered a failure due to 'over complexity'. It is interesting to note that the description of failures related to engineering failures rather than the complexity of the system. Indeed, the UK pilot schemes attempted to test concepts without recognising the full depth of requirements for such a system.

Further, the report has failed to recognise that the information available to the New Zealand Government has been used as inspiration for much of the United Kingdom roading reform programme. The concepts promoted in *Open Roads*[10] are of interest offshore, but the New Zealand Government has refused to recognise the same value locally.

Australia

The Australian camera-based tolling technology is referred to in the MoT report. It is recognised that this system is expensive to operate, and the MoT report has elected to include this type of technology as a secondary means of identification only, where a vehicle is not fitted with a transponder or where a transponder is not successfully interrogated.

However, the Australian system is an early 1990s technology system. The state of the art of electronics has moved significantly in the decade and a half since the Australian system was implemented. The relative costs of camera versus other technologies has changed rapidly, and the digitisation of camera technologies has enabled new methods of incorporating camera systems into a road tolling system.

The MoT report shows no signs of more advanced understanding of the uses of cameras beyond the early 1990s paradigm.

[10] Obren, Mark P. (1997). *Open Roads: Monopoly or Utility*. Auckland, New Zealand: Blacktop Services.

Conclusion

This document has pointed out that the MoT report is limited in its findings. Various OSC members have been advised that a full network charging model, which the report admits is the ideal approach, is not only feasible but more economic than the proposed system. However, the MoT report has focussed on a technology-based solution that is derived from Transit New Zealand's agenda.

However, experience shows that agencies such as the OSC will ignore these types of submissions. History demonstrates that every time one of these requests for submissions is asked for, the government agency involved then ignores the responses. The submitters are never given an opportunity to become part of the solution. Any promises to keep interested parties informed will be ignored as soon as the submission process ends.

You are given notice that this time is different. You will be held to account for your actions. That is the essence of public accountability.

Part 2 - Policy Outcomes

The road pricing policy is intended to raise revenues for infrastructure investment and to create a deterrence against unnecessary road use during congestion periods. However, whether intentional or not, the creation of such a system will have wider ramifications than these declared goals.

The following outcomes have been identified as stemming from the road usage system proposed in the MoT report:

- A New Zealand standard for future road pricing systems will be established.
- A barrier will be created from the use of more advanced technology in New Zealand for decades to come.
- New data services will be frustrated through a lack of necessary data collection infrastructure.
- The public sector model itself will become a barrier to further innovation and will fossilise New Zealand roading services standards.
- A revenue collection focus towards roading will be encouraged.
- New Zealand will be pushed into being a technology follower in the field, as New Zealand enterprises engaged in developing advanced roading systems will be forced offshore.
- There will be a reduction in New Zealand's technological base, with consequent long-term negative impact.

These outcomes from the current policy have been described in more detail below. They are all reasonably predictable outcomes stemming from the New Zealand public sector's insistence on controlling the future of roading in New Zealand, the exclusion of other stakeholders from the decision-making process and an intransigence regarding reneging on New Zealand's obligations to promote Public-Private Partnerships in developing New Zealand's information infrastructure.

A New Zealand Standard

Auckland is New Zealand's largest centre and the proposed roading pricing system would be placed in the densest traffic area in the country. As such, this area of road also represents the ideal place for introducing any new form of roading technology.

The technology that is introduced into this area, therefore, has a natural economic advantage over any competing technology. It is almost certain that whatever technology is adopted, whether superior or inferior, will become dominant in the country and thus shape the future of roading in New Zealand throughout the system's economic lifespan – at least two decades according to the MoT report.

Further, the 200,000 transponders planned for installation in Auckland vehicles represents penetration of some 7.7% of the New Zealand vehicle fleet. Any alternative technology introduced in Auckland would need to co-exist with these transponders, leading to duplication of costs and functionality. The transponders would thus act as a barrier to entry of more advanced capabilities into the Auckland market, and through Auckland's economic leadership of New Zealand, as a barrier to the country in general.

Any technology introduced for road pricing in Auckland would set a standard for replication across the entire country. Thus, the decision for Auckland is a national decision with significant economic consequences and not a simple local decision for raising revenues for Auckland infrastructure.

Deter the use of more advanced technology in New Zealand

Road Management systems are one of the new areas where technology can be applied to create substantial economic benefits both for the individual driver, business and government. The availability of mass produced GPS and wireless componentry has led to the design and manufacture of new technologies, both in New Zealand and around the world.

The implementation of transponder technology in Auckland would result in 7.7% of the vehicle fleet and the most economically attractive market being locked into a capital investment of inferior technology. The loss of road pricing as a potential service and the necessity to duplicate items fitted to vehicles would act as a barrier to new technology diffusion.

The result would inevitably be a long-term lag in new roading technologies in Auckland, and as a consequence of Auckland's position, throughout the country. The economic cost of these lost opportunities for new services and productivity improvements has not been calculated by the report. In fact, it is quite likely that these costs outweigh the revenue collection planned and would impose on New Zealand substantial negative long-term economic consequences.

Frustrate the data requirements for new services

Internationally there is a rapidly developing industry in adding value to cellphone and car position information. This industry has undergone enormous growth during the gestation of the report. Indeed, the lengthy nature of the roading decision processes in New Zealand makes practically certain that the market requirements for vehicle data will have been failed to be incorporated in the report and the proposed three-year delay before implementing any decision of infrastructure further ensures that any proposal that is not open-ended in its capabilities will not support the services that will appear by the time of the project implementation.

Indeed, the transponder solution advocated and the data collection points proposed fail to provide the data inputs for the new services that will be in international wide-spread use by 2010. They represent a closed system with closely defined purposes and no growth capability to allow for the needs of a future economy.

In fact, it is highly likely that the data requirements of the second decade of the century will ensure that the proposed system is obsolescent by the implementation date and would require its replacement by a more capable infrastructure long before the end of the planned 15-year capital repayment period.

Public Sector barrier

The report hints at a public sector organisation to operate the roading system. In fact, the report's failure to detail the organisational design for the system is a gap that is conspicuous by its absence.

A public sector body charged with operating road pricing systems would become an impediment to the future development of New Zealand roading. New Zealand Governments unfailingly confuse their separate roles as regulator and owner of public sector bodies, and place their ownership function above their governance functions. This role confusion leads to lower quality standards, decreased efficiency and lack of direct accountability to drivers.

Further, a public sector body with a vested interest would act as a barrier to private sector investment and involvement in streamlining and advancing roading systems. The public body would actively act against private sector initiatives, and thus ensure that New Zealand has reduced returns from new technologies and innovations.

Revenue Collection Focus

The report justifies the road pricing system on two bases: (1) to act as a deterrent to central Auckland road use in peak hours; and (2) to raise revenues for new infrastructure.

The revenue focus of the project has led the design to look for low implementation and operational costs. However, this is a classic static economic view of the Auckland situation and ignores the real economic dynamics in play.

The report's very focus has led to the exclusion from consideration of other important economic factors, such as the efficient use of roading resources, the effects of information infrastructure development and the economic and social returns from Auckland's technology base.

The revenue collection focus is a carry-over from traditional Government thinking of roading as an expense and not as an asset that can be leveraged for increased productivity and returns. Thus limited, static analysis can only lead to an inferior decision outcome compared with a dynamic approach.

Technology follower

A roading system based on transponder technology is undoubtedly a low cost option given yesterday's technology. However, transponders also have limited scope for future services.

The proposed solution threatens to place New Zealand in a 1990s style technological framework for decades, and thus position New Zealand as a technology follower and create a national competitive disadvantage[11] vis-à-vis other nations. The fact that one city in Sweden has used this technology is not good reason to condemn New Zealand to the same path.

Of course, the technology follower problem can be solved by simply replacing the whole technology, but in that case, the expected 15-year repayment period is unrealistic. Hence, the report must reconcile either its financial business case of a 15-year repayment of capital or condemn New Zealand to technology follower status.

[11] Porter, Michel E. (1990). *The Competitive Advantage of Nations.* New York, USA: The Free Press.

Reduced New Zealand Technology Base

First, the Government has an important role as a customer of technology. The New Zealand Government controls over 40% of the country's economy[12], and thus the public sector has a significant dominance of the country's economic activity. Further, some 90% of large New Zealand organisations are government controlled or dominated, and thus the dominance for advanced technology is even more extreme.

Second, practically every Government in the world encourages its own technology through targeted purchase of local production. Consequently, foreign governments expect that any worthwhile technology will have already been purchased by the government in its home country. The New Zealand Government's aversion to local technology purchase is simply incomprehensible outside of New Zealand.

Thus, failure by the road pricing project to purchase local technology will force any company in this field to relocate to another country to avoid the stigma of being ignored by the New Zealand Government. The consequence is a permanent loss of technology, skill and wealth to the New Zealand economy.

This type of damage is nothing new, and indeed has been a factor in the New Zealand ICT industry failing to achieve its potential[13] over the last decade. The economic damage of the road pricing scenario has not been included in the existing report, but is a substantial and real cost to the country.

[12] www.stats.govt.nz

[13] Crocombe, Graham T., Enright, Michael J. & Porter, Michael E. (1991). *Upgrading New Zealand's Competitive Advantage.* Auckland, New Zealand: Oxford University Press.

Part 3 - An Alternative?

By definition, every option has advantages and disadvantages or it would not be considered an option. The report's focus on the Stockholm model is an example of this truism.

Advantages

A transponder based system collecting data at points on the roading network backed up by cameras identifying plates of vehicles not fitted with transponders is a technological solution that has been around for over a decade. It has the following advantages:

- Proven technology implies that the New Zealand Government has transferred the risk from trialling new technology to another party. Free-riding off the innovation of others reduces the risk that the technology may not perform according to expectations.
- The technology has been selected by a foreign city. This selection lowers the perceived risk and in case of failure provides a scapegoat for transferring political blame. It should be noted that the selection does not change actual risk, but merely perception of risk.
- Transponders are simple devices to fit to vehicles, with minimal requirements to alter vehicles and without expensive wiring installations.
- Transponders are small devices that do not significantly interfere with the private benefits of operating a vehicle.
- Transponders are relatively cheap devices and are mass produced internationally.
- Camera detection technology does not require any alteration of a vehicle and has no cost of implementation in the vehicle. The licence plates carried by vehicles in New Zealand are already visible and readable in normal light conditions.
- The transponder technology captures only the minimum information required to bill road use. The camera technology can additionally capture driver identity and could be used for other purposes if the images were to be stored for further analysis.

Disadvantages

However, all options also have their weaknesses, or there would only ever be a single option available – which by definition is not an option at all. Thus, the existence of alterative solutions demonstrates that the proposed technological solution does have weaknesses, which include:

- The system is a deterrent against road usage in congested periods and a source of revenue collection. There is no economic benefit from the proposed technological solution. The proposed investment will not stimulate local industry, it does not enable value added services that can provide additional economic benefits to the motorist and there are no flow-on benefits from stimulating New Zealand's export capability.
- The technology is dependent on imported components which require foreign exchange to purchase. The report's pricing is based on New Zealand dollars, yet the inputs are foreign currency denominated. The system will consume foreign exchange and adversely affect the balance of payments, worsening the foreign account deficit and thereby weakening the economy in general.
- The system is designed for a single purpose system and has no scope for enabling future services.
- There are no direct benefits to road users from the system. The perception is that the sole benefits from the system are cash flows to the Government to fund roading, replacing funds which have been usurped for other political purposes.
- The system cannot provide an input into intelligent roading capability and will result in duplication of capabilities when an intelligent roading system is installed.
- The dated technological approach is liable to be overtaken by technological change. In fact, it is highly likely that the proposed solution will be obsolescent by the scheduled installation date. There has been no account taken of the rapid development of technology in this field, but rather, a justification of Transit New Zealand's approach derived from Transit New Zealand's restricted agenda.
- A Public sector implementation is likely to be inefficient compared to a private sector firm. The relatively simple nature of operation requiring collection of funds does not require the complexity of a public sector model. The New Zealand Police have tacitly admitted the same situation exists with their outsourcing of speed camera operations.
- There is an unspecified development risk implicit in creating new back-office systems. The lack of detail regarding the most complex part of the project is concerning, and suggests a lack of recognition of the realities of costs and risks in creating billing systems. There is significant financial and time risk implicit in creating large scale information systems and the New Zealand Government has developed a risk adverse attitude towards these projects, thus creating a political risk for the project from political interference.
- The project has a vehicle focus rather than driver focus, with vehicle movements being identified rather than driver movements. Yet, the costs of these vehicle movements are being borne by the people opening the account.

This mismatch between vehicle creating the costs and charging people blunts the economic incentive, as drivers operating another's vehicle will not be concerned with the congestion charges.

Alternative

There are always alternatives to any scenario. The question is whether there is an alternative that can overcome the weaknesses of the proposed system without losing the advantages. If such an alternative scenario existed, then it would then be superior to the proposed solution.

One alternative that exists has the following points of differentiation with the existing system, mitigating some of the weaknesses identified:

- The alternative system has a significant component of New Zealand intellectual property and would stimulate the New Zealand innovation in the ICT sector, with downstream benefits across the country.
- The alternative system has over 50% New Zealand content, thereby significantly reducing the impact of the system on New Zealand balance of payments and reducing the risk of foreign exchange movements upon project costs.
- The alternative system utilises current generation technology and incorporates 21st century capabilities, essential for creating intelligent roading systems.
- The alternative system is an open-ended system capable of supporting multiple purposes of direct value to road users and adding future benefits as they emerge over time.
- The alternative system can not only form part of, but can stimulate, the introduction of a intelligent roading capability. In fact, it would act as the core and catalyst of new roading systems in New Zealand. The system would act as a platform for releasing economic, social and environmental benefits not recognised by the existing road pricing system or by Transit New Zealand in their push for road tolling systems. Under this model, road charging is reduced to one of the services supported by the system rather than the single purpose of the system, thus taking advantage of economies of scope by spreading costs over multiple purposes.
- The use of an open-ended flexible platform rather than a static single-purpose platform provides future-proofing against technological change, with installed technology able to be automatically updated over time to add new functionality. The benefit to enhance over time to take advantage of technological change transforms technology from a threat to the project into a benefit.

- A private sector partnership in introducing such a service would reduce public sector involvement to those areas where public good is paramount, while a private sector organisation can be used to deliver straightforward operational objectives and to unleash the innovative and technological capabilities unavailable to the public sector. The result would be higher efficiency, greater innovation and direct access to technology.
- The alternative scenario is at a more advanced state of development than the proposed system and already has an operational back-office system capable of handling not only the road charging for Auckland vehicle use, but also vehicle usage across the entirety of New Zealand. The adoption of an existing system eliminates one of the major risks of substantial budget overruns and delays implicit in the proposed system.
- The alternative scenario identifies each driver and allocates costs against those that create the cost, rather than the owner of a physical asset. This driver focus ensures that economic incentives are well-targeted and thus enables the required deterrence effect to ease Auckland congestion.
- The alternative scenario encourages vehicle owners and motorists to accept the system through its direct benefits, and not because a law mandates its use.

Weaknesses of the Alternative

However, no scenario is perfect, so what are the weaknesses of this scenario compared with the proposed scenario strengths, and how do the realities of the differences compare with the perceptions.

- The alternative scenario has not yet been implemented in a major roading network. This fact alone would cause Transit New Zealand to ignore such an approach. However, such a decision ignores the fact that the solution is not required until 2010. At that time, the system will be installed in a number of roading systems in East Asia, Europe and Australasia. The first implementations in New Zealand are scheduled for 2006, with services being released in 2007, and therefore the alternative technology will be installed in Auckland before the proposed project. Hence, the perception of risk is actually misleading and the reality will be the comparison of a technology in operation against one merely in planning.
- The New Zealand Government is well used to following international trends to avoid the political risk of being blamed for failure. However, this analysis ignores the political risk run by the New Zealand Government in ignoring local products in favour of foreign products. A week is a long time in politics, and the political landscape can change rapidly. Thus, the apparent political risk is not what it really is, and any public sector project needs to be aware of the realities of public accountability.
- The alternative technology is quite small and user installable, and thus is no disadvantage compared with the proposed transponder system.
- The small size of the alternative technology does not create any significant loss of user benefit of their vehicle.
- The low operational cost of the transponder is matched by the alternative scenario. The alternative scenario provides a full roading service. The capital costs are met through the transaction costs. Therefore, there are ***no capital charges*** from alternative scenario and there is ***no cost for a back-office system***. Thus the alternative scenario is much more cost-effective than the proposed transponder model.

In reality the alternative technology surpasses the proposed technology on every level. The only factor in favour of the proposed solution the perception of political risk, but not the reality of political risk. The question facing the OSC group advising on road charging for Auckland is whether perception is more important than reality, and do they want to be publicly accountable for that decision.

Part 4 - The Fix

Introduction

The fix to the road network in New Zealand was first publicly described in *Open Roads*[14], which was submitted to the New Zealand Government review on roading in 1998. Since that time, the information has also been provided to other New Zealand Government agencies, including Transit New Zealand, and attempts have been made to engage the New Zealand Government in every review from that time.

Open Roads described technology leveraging research and technology development that had been conducted over the 1990s. *Open Roads* presented an advanced programme that revealed the weaknesses in the New Zealand Government's approach to roading and proposed a then-radical approach using network data collectors positioned along the road and GSP units fitted to vehicles. This information has also been used as inspiration to form the United Kingdom's ten-year roading programme.

Since the release of *Open Roads*, the technology to enable the vision described has been developed in Auckland. Trial units were available in 2002 and production-quality technology has been available since 2004. The database technology required to enable the online data capture and billing system finished development in 2005, thereby completing the last piece required to install and implement the first roading network. A variant of this technology was offered to the New Zealand Police for speed enforcement in 2005, and information relating to the project has been provided to Transit New Zealand in 2001 and 2004 – though in each of these cases the New Zealand Government has chosen to ignore the information. On the other hand, Trade New Zealand and the Export Credit Office, a branch of the Treasury, have been kept informed of developments from 2003 and have chosen to recognise the export potential of the base technology and business cases to other countries.

Internationally the technology has greater acceptance. One country in Asia is currently negotiating on implementing some of the services enabled by the technology, while it is planned to install the first system in Europe once the system has demonstrated its value in a smaller market.

Hence, the fix is based on a technology that the New Zealand Government recognises as having high value internationally and no value in New Zealand. This confusion of interpretation of the situation is indicative of the role confusion inherent in the New Zealand Government agencies between carrying their governance function and acting as a service provider – the role confusion blinds the Government agencies to the benefits inherent in alternative situations where they perceive they have a service provisioning interest.

Thus, the fix describes a solution that the New Zealand Government does not want, as it undermines the political interests of several agencies. However, the fact it is not

[14] Obren, Mark. (1998). *Open Roads: Monopoly or Utility*. Auckland, New Zealand: Blacktop Services.

desired by the Government does not change the facts that advanced technology with superior economics is available.

Hence, as the public sector is disinterested in the technology, the technology will be introduced by the private sector. The first New Zealand installation will be completed during the second half of 2006 and it is intended to roll-out a wider infrastructure by the end of 2007. This infrastructure programme has already received all necessary planning approvals and has been funded by international investment. The infrastructure will deliver value-added services and can provide a road charging service based on a competitive transaction charge with no capital requirements.

Therefore, the infrastructure required to enable an intelligent roading system is going to be available before the implementation of the Auckland road pricing project, regardless of the decisions made by the Government.

The technology design

Design details

On the surface, the enabling technology is of no interest in the provisioning of service. Utility companies such as telephone and electricity companies provide services using a multitude of products and services without disclosing the details to their customers or to the Government. It is a level of detail that is not required to be understood by the layman or by regulators.

However, in this case, there is an implicit design in the Auckland road charging proposal to insource the provision of road charging. Hence, in order to demonstrate a valid comparison, it is worth considering the technological issues further.

Data Capture

The system captures vehicle data within the vehicle over time by a data collection device. This data is locally stored in a raw form, and provides the basis for value added services, including route planning, automated log books, accident alerting, insurance services, driver monitoring and traffic rule advise and enforcement. Road charging is only one service that can be enabled by the unit, and supports multiple cordon, full network charging, parking and area charging models as required.

The data capture device includes identification systems to positively identify the motorist. The system then allocates the charges to the correct motorist and provides services based on their pre-set preferences.

The current generation of the data capture device includes a small touch screen to allow motorists to select options, enter data and display results. A GPS unit is built into the device to enable it to monitor vehicle movements at all time. An internal battery provides power to the unit, and the system is recharged when in use.

Data Collection

Data collection devices are placed every 100 metres along the roading corridor. These systems have built–in wireless networking capability to both link to each other and to communicate with data capture devices that pass by. The data collection devices download data from vehicles for storage and processing account charges in real-time, while information on value-added services are picked up by vehicles to ensure up-to-date information on road charges incurred, road congestion, road works, travel times based on road condition and accidents ahead is available to the motorist.

The intelligent nature of the network design rapidly identifies any single node failure. Maintenance personnel can be despatched to replace faulty units or devices that have been damaged or destroyed by an accident or by sabotage.

The wireless capability of the network ensures that it remains independent of land-based infrastructure – eliminating supplier infrastructure failure as a risk to system. The use of multiple routes further reduces the risk that information will not be passed along the network as required. However, to ensure that wireless interference is not a problem, the data collection devices have the capability to pass information across a standby alternative wired system.

Further, as all data collection devices store information locally, any network interference will only delay the passing of information and would not result in any lost transactions.

A more capable version of the data collection device is installed every kilometre to identify unmonitored vehicles or unusual activity. These camera cluster units contain cameras with 360 degree views and provide the basis for traffic monitoring, security reporting and tracking services. The camera clusters identify number plates of vehicles for enforcement purposes. The dense installation of these devices precludes the need for mobile enforcement units, saving significant expense.

Roading Infrastructure Devices

The intelligent network monitors traffic levels across all roads in its area. The system can be used to manage traffic lights, rail crossings and pedestrian crossings, based on improving traffic flows and minimising disruption.

The consequence is higher traffic capacity through areas with these types of devices.

Flexible Charging

The intelligent network enables flexible charging models. Pricing can be set in the network based on time of the day, congestion levels, day of the week, business day versus non-business days, holiday periods, weather conditions, light conditions, vehicle type, driver licence type or other specified factors. Drivers are warned of pricing of alternative routes at the beginning of each trip and as prices vary over time, thus providing the alternative of modifying their route to minimise costs – and thus maximise road usage efficiency.

The road charges can be applied by any pricing model. Cordon pricing can be applied as vehicles pass pre-determined points. Area charging can be applied within specified zones. Parking pricing can be applied whenever a vehicle parks in a specified area. Full network charging can be applied, where the price depends on the distance covered and the charging regime in practice at the time.

The flexibility to modify pricing provides a strong price signal to the consumer that can enable them to modify behaviour. The consequence is a system that can readjust itself more easily than static charging systems, and thereby allow a greater traffic flow across any road network.

Billing System

The intelligent network is based on each user having a pre-pay account with the service. This business model is already used for Road User Charges, where the motorist prepays for a given distance.

In the event of a person not having sufficient funds for the journey, or a motorist not been pre-registered with the service, then the person can create an account and transfer funds directly using the Data Collection device for EFT-POS or credit card transfer.

If their vehicle does not contain a Data Collection Device, then they can make payment by the Internet, cellphone TXT or by calling a call centre. An additional transaction charge would be levied against a call centre charge, to recoup the higher costs involved. A further alternative is that a person can deposit funds into a specified account at a bank branch.

The motorist can receive a balance of remaining funds at any time from a Data Collection Device or through a pre-determined Internet access device or cellphone.

The billing system is operated at a central node of the network, with data storage spread across the network taking advantage of the distributed computing technologies. This system has access to an Internet gateway and TXT interface to communicate with external systems to enable financial transactions.

Privacy

The database technology used for the system is designed to restrict access to an individual's data to that individual. The system uniquely identifies each driver based on pre-supplied biometric data and assigns access rights to information containing their details. No other person can access a person's data directly.

Generalised data is available based on factors that are sufficiently general as to prevent the identification of a single individual. The data is used to enable derived information used for providing value-added services, including traffic monitoring and enforcement services.

Cost Implications

The alternative service is available with a more competitive cost structure than the proposed scenario. The key financial issues are:

- No more than $0.4/transaction cost
- No development cost
- No capital cost
- No installation cost
- No financial charge for bank deposits

Call Centre services can be provided or interfaced to the service to provide for people without access to a vehicle with a data collection device, the Internet or a cellphone. The number of these people is expected to be very small. The cost for a call centre would be similar to those costs estimated in the Auckland road pricing report, and would be passed onto the consumer to encourage their use of more cost-effective payment options.

System Design Implications

The technology and systems are available to enable a full network use charging system on New Zealand roads. This statement is at odds with the statement in the report, which claimed that full network charging was not yet a practical option.

In fact, this alternative system represents a low business risk and uses technology that is available in 2006. There is no development required of background systems to implement this system, thus eliminating a significant political, financial and time risk from the project. The introduction of this service by a private sector organisation removes any operational implementation problems with customers from the political arena, and thus minimises the attendant political risk.

The alternative technology is New Zealand intellectual property, incorporating over fifty per cent New Zealand content and its adoption will stimulate the New Zealand economy. Further, a New Zealand technology reduces the foreign exchange implications by replacing foreign value with New Zealand value.

Financial Implications

The MoT report's failure to consider all of the alternatives has led it to consider a less than optimal economic solution. A system based on the described technology above offers new economic possibilities, whether using a transponder style solution or the alternative GPS based approach.

The Transponder Scenario

A solution can be based on the standard transponder model with data collection at locations along the roading corridor. These units can be mounted onto existing poles, eliminating the need for expensive installation costs.

The area enclosed by the single cordon scenario is the largest of the report's five scenarios. The area enclosed is approximately 16.9km by 12.4km in size at the widest extent. If one assumes that the enclosed area for the single cordon scenario is approximately 200km^2 then a full network charging service based upon each service point having a 100m x 100m collection capability, or 0.01 km^2 coverage, would require 20,000 data node units. In practice, the roading coverage of the area is incomplete and thus a smaller number of collection points would be required.

The data node devices are available at $200 in value each. Thus, based on the conservative estimate of numbers required to cover the area, an investment of $4 million is required to establish the data node network. These nodes use a wireless network capability to communicate with each other and pass data along the network.

Non-transponder vehicles can be recorded by camera cluster units located periodically throughout the area, and can act both as a data node and a device to identify vehicles from number plates. If one assumes that one camera cluster unit is located per kilometre of road, then 200 camera clusters would be required to provide full coverage. An investment of $5000 per camera cluster contributes a further $1 million to the capital requirements, but would replace $40,000 of data nodes.

The system can automatically monitor the performance of each node and alert maintenance services if a data node became defective or was destroyed. The account information is supported on an external service supporting account information for each motorist. Financial transactions need only be passed to and from the banking network when customers top-up their pre-pay accounts. The account information would be accessible to account holders over the Internet through a secure system

Thus, there is no need for an expensive backbone network, a central control room or data processing facility, while account transaction fees are minimised through the use of a more efficient system.

The Alternative Scenario

However, if an alternative technological approach using data collection devices mounted in vehicles is adopted, the economics are quite different. The data collection devices would monitor vehicle movements and download the information when the vehicle next passes a data node. This technical solution was proposed as an alternative approach in *Open Roads*. The report dismissed the use of GPS technologies on the assumption that they would be more expensive than DSRC technology, based on a GPS cost of $250 per unit. However, these economics are different from the economics available and represent a technology fundamentally different from proposed in *Open Roads*.

Further, there is a fundamental difference of approach regarding whether the equipment should be single-purpose or form part of a range of services available to motorists.

As the data collection devices are multi-purpose devices, the full capital expenditure cost is spread across multiple services. The contribution from the road pricing service would be limited to its share of the use of the equipment. If one assumes that the data collectors are used 40% of the time for road pricing, then an $80 contribution to the capital expenditure is reasonable. This is the same budget allocated for transponders in the report's models.

The capital expenditure would be met by the private sector organisation. In effect, the transponder capital expenditure would be allocated as a subsidy to assist in the installation of the service and the private sector would take the risk of promoting value-added services to gain a return on the overall investment.

The report estimates 200,000 vehicles would be regular customers of the service. Data Collectors can be mounted into vehicles for $200 per unit. The total capital expenditure for installing these units would thus be $40 million. A 40% contribution would thus equate to $16 million. In practice, the private sector organisation could provide the road charging service through transactions fees in order to recoup the capital expenditure, while the Government would be able to avoid making any capital commitment, while the motorist would have access to services providing additional economic value.

The Financial Comparison

The financial results for the alternative scenario can be set to access revenues on actual vehicle usage of the congested areas both by distance and by time of the day. There is no need to set a standard fee for a four-hour time, as used in the scenarios in the report, but it is accepted that simplification would ease public understanding and improve acceptability of road pricing.

The measurement of vehicles at different points, rather than just at the cordon, for the area of the congested area surrounded by Cordon One, as referred to in the MoT report, creates new revenue options. It is assumed that the revenue rate could be adjusted to reflect the different measurement options, but the overall revenue collected would remain similar to the existing scenario to ensure that congestion pricing acts as a deterrent for unnecessary road usage.

The Capital Expenditure budget for the alternative scenario is $23.3 million for the initial capital expenditure and $52.3 for ongoing nominal capital expenditure, based on the MoT report assumptions. Ongoing costs have been calculated using the original scenario assumptions, with $40.7m for the initial year and ongoing costs in proportion. However, it is expected that a close examination of data unavailable in the report and analysis of alternative traffic charging patterns would result in significantly lower costs.

Thus, the alternative scenario is expected to have significantly improved economics over the report scenarios, leveraging off a superior technological and economic base to deliver superior performance.

Notes:

The installation of data nodes is based upon free access to appropriate poles, as required under law. A charge of $20 per node reflects the labour and transportation costs incurred by the installation service.

It is assumed that the same level of signage and road marking will be required for a full network service. The purpose of the signage is to warn motorists that they are entering a ‘charged zone’ and giving them adequate warning before incurring the charge.

The commissioning cost of $400,000 has been included in the calculations as the costs to conduct testing of the system before commissioning.

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Conclusion

The proposed system will reach its first stage of roll-out within twelve months. The new service is fully capable of supplying all required road pricing services at superior economics to the proposed system. The Auckland Road Pricing OSC group has the alternative of sponsoring a demonstration of the technology in Auckland or it can wait until 2007 like the rest of New Zealand. Either way, this technology will be in place from 2007.

The real question is whether the Government wants to work with or against the private sector in revolutionarising roading services in New Zealand.

Part 5 - The Effect of the Fix

International Standard

The alternative road charging systems would provide an international reference site for newly developed technologies and create a domestic market and industry to provide value-added services over such a network. The result would be a cluster of innovations focussed on creating and enhancing a system that, by its very success, would become a world-wide future technology standard.

There are economic repercussions in the creation or denial of this economic activity that dwarf the financial costs of the proposed system.

PPP

The introduction of a public private partnership to implement road user charging would have significant ramifications in New Zealand. There has been a significant drift towards public sector service provision in New Zealand over the past few years, based on the ideological belief that the public sector is inherently better than the private sector.

This position is untenable. The practical experience of New Zealand over the past few decades, the weight of academic research and the very actions of social democratic governments in other countries, such as the United Kingdom, demonstrates a widespread understanding that the PPP model has superior capabilities to service provisioning by a monopolistic public sector service organisation.

The New Zealand PPP experience is extremely limited. The New Zealand Government has considered roading as one area where a PPP could be applied and Transit New Zealand has gone to some lengths to develop a methodology in operating PPPs.

However, the New Zealand experience has failed to date due to a conceptual flaw in public sector thinking. The New Zealand Government, and Transit New Zealand in particular, have perceived the private sector's role in a PPP as the supplier of funding while the areas of innovation, technology and organisation are supplied by the public sector.

This is the reverse of an effective PPP model. Instead, each party should bring those values it has to the PPP to maximise the effectiveness of the partnership. Government has access to cheaper finance than industry, and thus should provide the financial input. Industry is more efficient at operating within well-defined parameters and more adept at enabling innovation, with consequent productivity implications, and thus should provide the technology and organisational components. Hence, it is hardly surprising that no private sector organisation wishes to partner with the New

Zealand Government in a model which uses the weakness of each sector to provide what can only be a less effective outcome.

Therefore, the adoption of a PPP for road pricing project where the private sector was allowed to bring its assets of innovation and organisation would be a signal throughout the public sector on how to deliver outcomes more effectively. It would allow the public sector to focus on policy creation and enable a wider range of projects to be undertaken within given budgetary constraints. It would separate the implementation issues handled by PPP from the Government and minimise political risk. It would increase the positive economic returns from a project, as a consequence of greater efficiency.

Further, the New Zealand Government suffers from role confusion where it acts as both regulator and service provider. A PPP provides a mechanism where a Government can effectively restrain undesirable behaviour by contract and by regulation. These restraints generally prove ineffective when dealing with a public sector organisation.

In addition, New Zealand has an international obligation to the United Nations to introduce an ICT PPP by 2005[15]. This agreement recognised that the "private sector is important in developing and diffusing information and communication technologies (ICT) for infrastructure" (WSIS, 2003[16], p.1). Furthermore, it was recognised that "the private sector is not only a market player but also plays a wider sustainable development context" (WSIS, 2003, p.1) in developing and diffusing ICT for infrastructure.

The New Zealand Government's actions to date in promoting effective ICT PPPs are restricted to subsidies to a small number of infrastructure companies, and in general, the New Zealand Government has failed to meet the spirit if not the letter of its obligations. A PPP for road user pricing would be a highly effective method of meeting international requirements while at the same time achieving worthwhile economic, environmental and social benefits.

[15] World Summit on the Information Society (WSIS). (2003). Plan of Action. *ITU.*
[16] World Summit on the Information Society (WSIS). (2003). Plan of Action. *ITU.*

Environmental

Motor vehicle emissions are one of New Zealand's greatest forms of pollution. Carbon dioxide, sulphur dioxide and monodioxide are all consequences of vehicle use. The reduction of carbon emissions from vehicles is one of the most effective methods available to New Zealand to meet its commitments under the Kyoto protocol.

The alternative roading system, based on an intelligent network technology, would result in more efficient flow of traffic. The minimisation of time required for vehicles to reach their objectives has a byproduct of minimising the emissions emitted from these vehicles. Sensors can be incorporated into vehicles to monitor emissions and high emitters can be charged a surcharge for use of the roads- as an incentive to switch to reduce emissions through improved maintenance or changing vehicle types.

Indeed, a bold initiative is required if New Zealand is to meet its Kyoto Protocol targets. The cancellation of the carbon tax has created a situation where conservation measures can only reduce emissions by 2-3%, compared to the 20% reduction ratified by the Government as its commitment by 2012[17].

The alternative network has an input into New Zealand's performance in meeting its Kyoto Protocol targets. In fact, the alternative network provides the only option by which New Zealand has any chance of reaching its Kyoto targets.

Economic

A more efficient transportation system has a direct economic benefit to motorists through minimising fuel cost and reducing the opportunity cost lost in transit.

The inherently more efficient network charging system of the alternative scenario would reduce the real costs to the motorists. If one assumes that congestion costs remain constant, in order to provide an effective deterrent value, the greater efficiency enables a greater proportion of the revenues that are raised to be available for allocation to transport infrastructure projects.

In addition, the use of advanced New Zealand technology would stimulate a technology cluster in Auckland. The intelligent network would create a platform for New Zealand value added products and services to compete for international projects, such as United Kingdom 10-year roading plan. This cluster would contribute towards the New Zealand economy and would have a material affect on New Zealand relative economic performance vis-à-vis OECD, both directly and indirectly.

Further, the use of New Zealand technology would result in increased GDP, leading to enhanced income to NZ Government. The enlarged export receipts from exporting technology would add support to the New Zealand dollar and ease the foreign exchange deficit.

[17] Scherer, Karyn. (2006). New Zealand: No Place for Science? *The Business.* (April 3, 2006).

Finally, the application of this technology would return New Zealand to being an economic model for other countries. The international prestige from being a leader rather than a follower is difficult to quantify, but is of immeasurable value to both the public and private sector.

Social

The minimisation of harmful emissions would have a positive impact on the health of Auckland residents. A reduced exposure to harmful substances positively impacts rates of asthma, cancer and many other conditions. The reduced impact of pollution on health has an impact on life expectancy, quality of life, work place productivity and the social cost of providing health services.

Health services and the costs of accidents is also directly affected by the alternative roading service. Accident rates can be improved by warning drivers of dangers ahead. Emergency vehicle access to injured people is improved. The combination of early advice of an accident and the streamlining of access to the site allows intervention at an earlier stage, thus reducing the costs and risks associated with the accident. The consequential savings on the accident compensation and health budgets are estimated at around $500 million per annum, dwarfing the costs of the alternative roading service.

Further, the more efficient use of transport reduces the real time spent by motorists. This time can be better spent on personal lifestyle and family activities, with real social benefits to the community.

Conclusion

The proposed alternative scenario has positive impacts on New Zealand's economy, social conditions and environment. It offers superior economics to the report's proposed transponder/camera-based system, while creating the base for developing a substantial contribution to the New Zealand economy.

However, the road pricing project has inadvertently raised a series of important questions that will impact on the development of New Zealand for decades.

A series of questions have been identified:

1. Is the perception of political risk more important than the reality of political risk? Does the road pricing group want to be held publicly accountable for answering this question?
2. Does the Government want to work with or against the private sector in revolutionarising roading services in New Zealand?

The answer to these questions will set the tone for New Zealand for some time. There are economic and political consequences from the decisions that need to be made, and New Zealand's very place in the world will be affected. The current project has merely brought some developing issues to the fore, but the answers are highly relevant and are a strong signal as to whether New Zealand is engaging with or retreating from an information society.

The intelligent network is coming. How you wish to react to it is up to you.

Part 6

The Solution

Introduction

The alternative roading service is one of a range of services being introduced around the world. Associated companies are launching products and services in the infrastructure, security, secure transaction, network services and other markets, leveraging off a common research and technology base.

Roading is recognised as a key market niche in any information society, with its impact on the ability to facilitate the transport of people and goods. The introduction of an information infrastructure into a roading network offers many opportunities to improve productivity, reduce environmental impact of transport and enhance social conditions.

The roading service uses an ID card to uniquely identify each motorist and to ensure the privacy of their information. A wide range of services are enabled by the system, allowing the delivery on behalf of organisations and enabling motorists to access services that add value to their situation. The open-ended nature of the service ensures its continuing economic relevance as technologies and services evolve.

The service is physically delivered through data collection devices mounted in cars. Network nodes collect data from passing vehicles and exchanging data to enable value added service and data reliability. Camera clusters mounted regularly along the roading corridor monitor road usage and identify motorists incurring road charges without suitable payment processes in place.

These items are described in greater detail below and form the solution that together make up a roading service fit for the 21st century motorist.

ID Card

The service is available for anyone who is a legal and natural person. The services are not restricted to drivers or to owners of vehicles, as the services form a subset of a wider range of services available beyond the roading environment. The necessary legal framework is already in place to enable this service.

Customers apply for an identification card and for an account to be established on the service. The identification card (ID) is keyed with their personal details to eliminate duplication of customer IDs. A digital image is taken of each card holder as a means of verification of cardholder identity.

The ID card is an RFID card, which meets the international requirements for national identification cards. The same card technology has been made available to a number of nation-state governments for use as their national ID cards, thereby eliminating card duplication and ensuring the highest standards of ID protection for citizens. Each ID card is fitted with a beeper that makes an audible sound whenever the card is probed. The positive response provides the ID card holder with the security of knowing when they have been identified, thereby reducing the natural tension people suffer when under constant hidden surveillance. The response also provides a feedback mechanism that tells the ID card holder that their card has successfully activated a particular device.

The data collection device in the car detects the RFID card that sits in the drivers' seat and identifies the driver. Any costs incurred and the information collected is allocated to that driver. The driver's identification is confirmed by a biometric reader built into the data collection device or by a pin number, depending on the model involved.

The roading system then personalises its information to the driver's preferences. Information can be presented in a number of different ways, reflecting personal preference and any add-on equipment available.

In the case of an ID card being stolen, the biometric test will fail its test, the ID Card would be locked out from the system and an alert would be posted that the card has been misused by an unauthorised user. A camera cluster in the roading corridor will take an image of the driver as the vehicle passes along the road and facial recognition technology would be used to compare the facial structures of the card holder with the image of ID card owners on file. Photographic evidence of the person with the frozen card is used to follow-up on the ID card misuse.

The owner of a lost or stolen ID card may apply for a new card for a nominal fee. The old card is disabled by the system, to prevent misuse. If a disabled card is attempted to be used, then the system will detect that use and take an image of the card user in order to identify the person.

Fraud and ID theft are taken very seriously and there are no exceptions or excuses. The combination of a strict policy and technology used by the roading service guarantees the most secure service possible in order to protect the customers from ID theft and from being billed for services supplied to another person.

Privacy

Privacy is a necessity of people. Constant surveillance and lack of privacy creates heightened stress and anxiety[18], leading to low productivity in society, distraction with consequential increase of accident rates and a range of health consequences.

The modern world has substantially eroded the privacy of people in all areas of life. Governments use hidden surveillance to watch citizens in public areas. Corporates watch employees in the workplace. Retailers watch customers in their premises. There is scarcely a place people can go outside of their doors where they are not subjected to a form of invasion in what would have been considered by earlier generations as private space.

Further, the ability to store massive amounts of information have led to the capture of large amounts of information on every person. One characteristic of these systems is function creep, where the information ends up becoming used for purposes beyond that for which the information was originally sanctioned or supplied. The public sector is particularly notorious in this regard.

The provider of the alternative roading service, *Transportibl*, takes privacy seriously.

All information collected specific to an individual is linked to that individual only. The database technology ensures that only that individual can access information linked to their ID. Other people can only access generalised information about the person by using criteria that does not include the ability to identify a single person, unless they receive the explicit approval of the owner of the information.

Further, the ID information of a person is contracted as the property right of that person. The transfer of copyright eliminates the potential for abuse of the information for the convenience of a third party.

This degree of privacy protection is an essential safeguard to ensure customer support of such a service.

[18] Dawanksi, George, Privacy Commissioner of Canada. (2001). *News release of investigation of video surveillance activities by the Royal Canadian Mounted Police in Kelowna, B.C.*

Services

The roading system uses data collection devices located inside vehicles to monitor and record vehicle performance. This data is automatically passed to the roading network as the vehicle moves along the road, with access points located alongside and within the roading corridor to collect data.

The data is used to provide a wide range of services, including:

Relative Location logging

The position of the vehicle is determined by a combination of GPS coordinates and road markers within the roading corridor. The device can determine its location both in a point of space and relative to other vehicles.

If the vehicle is stolen, the vehicle location can be accessed to locate the vehicle. The record of the vehicles movements and other vehicles nearby can be accessed to trace the thief's movements and any vehicle which the thief may have had contact with.

A second use of location logging is the monitoring of a vehicle to ensure it is used within restrictions. An employer may restrict a vehicle from being taken home by an employee, to avoid the cost of fringe benefit tax. A rental car company may restrict a vehicle from leaving a pre-determined area. A person lending a vehicle for a purpose may restrict the vehicle to that purpose. In these cases, any use of the vehicle outside pre-determined parameters would trigger an alert for the vehicle's owner.

Insurance

The Insurance industry is interested in more closely measuring driver risk to minimise their exposure to drivers who pose bad risks and to provide more competitive packages for drivers who are good risks. The service provides the motorist with the option to provide information to the insurance body in exchange for the possibility of reduced insurance premiums.

If the driver elects to participate in the insurance service, then the data collection device can provide feedback to drivers regarding driver behaviour that increases risk. A driver's behaviour is compared to the average behaviour on a given road and information provided to enable the driver to adapt their behaviour. The driver is rewarded for good driving habits through discounts, rebates or other inducements.

In the case of an accident, the system's records show the relative positions of the vehicles involved and thus can determine fault. This evidence eliminates lengthy insurance investigations and speeds up claim processes.

Location

The vehicle's location can be displayed on a GIS map if the vehicle is fitted with a suitable add-on display. The driver may use the map to navigate towards a destination, with audio prompts warning of upcoming turns and alternatives. The vehicle trip can be displayed on the map as a record of the trip.

The location log can also be used in the same manner as an aircraft 'blackbox', as it provides information regarding the vehicle's operations prior to an accident. The camera in the data collection device records images of the situation in front of the car, and the photographic evidence can provide a context to an accident. Investigators can access this information to provide guilt or innocence of the parties involved. The continuing transfer of data from the data collection device to the network ensures that in the unlikely event that the data collection device is destroyed in the accident, then the data up to the last small period remains intact and available for use by the investigation team.

Road Warnings

The roading system provides warnings of problems on the journey.

Weather information is provided, to warn the driver of rain, snow, fog, wind or ice conditions. The road status is flagged to ensure that the driver is aware of road closures, detours, road works or special events such as cycling or parade that may delay traffic. Information on traffic conditions is provided, to allow the driver to avoid areas of slow traffic flows and high congestion.

Route Planning

The driver can plan the route from the location to their destination. The system can show alternative routes, with estimated time of arrivals taking into account congestion, road works and weather conditions.

The system can also estimate the cost of the trip through each route, taking into account the cost of road charges (including variable charge options) and estimated fuel costs for each of the alternative routes. The driver can then select the route that most suits their requirements of time and cost.

Automated Logbook

The system can provide an automated logbook meeting statutory requirements for commercial vehicles and fringe benefit tax requirements for passenger vehicles. The automated logbook eliminates the lost time and productivity from drivers being forced to focus on the administrative needs of logbook maintenance.

An automated logbook also removes risk to commercial drivers of receiving criminal convictions for the perception of clerical errors by traffic police. The standard approach of the logbook service further standardises the application of logbook law and removes the current variation of logbook rule application by traffic enforcement officials.

Further, the automated logbook data is passed to the network as the vehicle moves past network nodes. The logbook data can be accessed by traffic enforcement officials without the need to stop the vehicle, resulting in more efficient use of traffic officer time.

Finally, the logbook provides a social service in maintaining a reasonable documentary standard for commercial vehicle operators.

Emergency services

The roading system monitors vehicle activity. The system is aware when the vehicle is positioned or acts in an abnormal condition that is systematic of an accident. A vehicle that has suffered extreme deceleration or upside down is highly likely to have been in an accident.

The system can automatically trigger an alert of a suspected accident. The unit includes a deadman switch that alerts the driver of a suspected accident to give the driver an opportunity to override the alert. If the driver does not intervene in a preset period, then the system alerts the network of the accident.

This service has a direct social benefit of reducing the chances of people dying after an unobserved accident, simply because the accident remains unseen for hours or days.

Further, the presence of an accident is flagged to the traffic management database, thereby alerting other drivers of the accident and providing them the option to change routes to avoid potential congestion.

Emergency Vehicle Approach

The data collection device fitted to each emergency vehicle informs the network of the emergency vehicle location, in the same manner as every other vehicle. However, when an emergency vehicle activates its lights and/or siren, then the data collection device informs the roading service which in turn advises vehicles in the vicinity of the presence of the emergency vehicle. Data collection devices connected to add-on car speakers or headphones over-ride the sound of the system to alert the motorist.

This service enables an emergency vehicle to operate more freely and respond to emergencies more rapidly, with substantial social benefit.

Road Charging

The roading system can collect road charges for roading authorities. Charges can be levied on the basis of actual road usage, the passing of demarcation points and the use of parking alongside the roading network. The charges can be varied according to the time of the day, type of day, the traffic conditions at the time, the weather conditions, light conditions, road status, driver profile, vehicle profile and insurance status.

The road charging system can automate road user charging regimes, with an electronic record replacing the paper ticket displayed in traditional systems. The system is also aware of warrant or certificate of fitness status and vehicle registration status, thereby enabling the vehicle to automatically respond for traffic officer's interrogation of the vehicle without the need to stop the vehicle for inspection or for a clear line-of-sight for visual inspection by the traffic enforcement officer.

Vehicles are not charged for off-road or private road usage, as the system is aware of the location of the vehicle at all times, and when it enters and exits the roading network. This distinction between road network usage and total usage eliminates any inequity over poorly targeted road usage charging systems.

Parking Metering

The data collection device detects when a vehicle is parked in the roading corridor in an area where parking is metered. The meter charge can be automatically deducted from a roading charging account or directly from a parking meter account. The use of the system to handle metering eliminates the need for parking meters and pay and display equipment, saving substantial capital expenditure.

The system is self-policing, as the data collection device knows who parked the vehicle, how long it has been parked and during which time periods it occupied the park. There is a substantial saving in operating expenditure through eliminating parking wardens. The use of parking is also monitored more accurately, resulting in improved revenue collection.

Further, if a vehicle is abandoned or a driver has failed to return in a preset time due to an accident or some other cause, then the data collection device can call a tow truck before the vehicle becomes a traffic hazard. The owner benefits directly, being charged a standard call-out fee rather a tow-away charge.

Entertainment

The data collection device can be optionally configured to receive streamed audio/video entertainment services across the network. These services can be played through the vehicle's speaker system or by wireless headset.

The streamed service enables greater access by broadcast services to the driver market, without the traditional interference problems related to radios. Further, the use of MPEG-4, MPG3 and other decoders enables a higher quality of service than available through traditional stereo services, such as FM radio.

Integration with sensors

The data collection device can also be optionally linked to sensors on the vehicle. Commercial vehicles can fit or have fitted sensors to measure fuel flows, brake usage, axle weights, tyre condition and distance travelled.

The roading system can incorporate this information to provide a vehicle management system, to enable vehicles to be operated more efficiently and economically.

Administration

The roading system maintains accounts for each identified customer. The system enables the customer to top up their pre-paid account from their bank account using the data collection device. Roading fees and service fees can be paid through this system.

The information collected by the device can also be transferred to a person's accounting system, using a data export capability.

Technology

The technology enabling the roading system consists of three main components: data collection devices mounted in vehicles, camera clusters mounted on poles and network devices mounted within the roading corridor.

Data Collection Device

The current generation is the data collection device is small enough to be mounted on the sun visor of a vehicle. The unit size is dictated by the screen used to supply information to the customer to enable interaction with the system. The system is powered by an ARM 9 processor, which provides ample processing power for the service while minimising power consumption and heat dissipation.

The device uses proprietary software to supply the service. A custom network database runs in the internal memory, enabled by the proprietary ANNTS operating system. Local storage is held within the device, using solid state technology. Applications are accessed with the touch screen and a menu system. Internet access is supportable as required for specific services.

The data collection device has no moving parts. This feature minimises the risk of vibration damage and ensures the most reliable installation in each vehicle.

The technical specifications of the current generation of the premium data collection device are:

OS	ANNTS
RAM	128 MB
Screen	LED touch screen
Resolution	80 x 1 characters
Colour	65536 colours
Wireless	802.11b/g
USB	1x USB v2.0
Bluetooth	Yes
GPRS	Yes
GSM	Yes
Camera	2 Megapixel
MPEG4	Yes
Battery	Ni-MHy
Processor	Samsung S3C24A0 400MHz
Dimensions	120 x 77 x 32 mm
Weight	200g

Note: Specifications are liable to change without notice as models are enhanced to incorporate ongoing technology improvements.

The technology is designed to meet international standards and open systems principles. The use of USB, Bluetooth and 802.11b/g standards enables a wide range of existing third party devices to be added to the data collection device. Third parties add-ons such as Bluetooth headsets, second screens for displaying map data, enhanced sound equipment, and other systems can be used to tailor an installation and to increase the benefit of the roading service.

Motorists can purchase this additional equipment from retail outlets or online from suppliers.

Network Nodes

The network nodes are located every 100 metres along the road. They can be mounted on existing poles, within modified road side markers or in cats-eyes built into the road. The mounting technique used is dependant upon the existing road infrastructure, regulatory issues and local property rights.

Network nodes collect data from passing vehicles and store files in local solid state storage. The network nodes are interlinked by a wireless network for data interchange. The system replicates collected data across the network, to ensure data integrity in the unlikely event of a system failure or accident that disables a node.

The data collection devices access information from network nodes in order to provide value-added service.

Camera Clusters

Camera clusters are disc shaped devices measuring 25cm in diameter mounting up to six cameras to provide a 360 degree surveillance capability from a single location. These units are used by the roading system to identify drivers and vehicles that incur a roading charge but do not have a data collection device fitted to the vehicle, or where a data collection device is fitted and the vehicle is driven by a person without a valid ID, to identify the driver who has incurred the roading charge.

The camera clusters are completely automated. There is no need for an expensive control system in order to take advantage of the technology. Further, as the camera clusters capture digital images, there is no need to visit the camera cluster compared with changing wet-film stock in traditional camera systems.

The relatively small size of the camera cluster ensures that they are not immediately obvious to the passer-bys and to motorists. Camera clusters are usually mounted on power poles to ensure good surveillance ranges.

The camera clusters take and store a high resolution picture of oncoming vehicles to identify drivers and compare with the database image. This measure provides verification that a driver is using their ID card, and therefore the system is collecting information for the correct person.

In addition, the images provide evidence for enforcement purposes for drivers who incur roading charges without paying for the service. Enforcement services such as the Police can purchase relevant information relating to an incident, such as an accident, fight, theft, as required. An offender can be traced back across the roading network from their starting point, providing a clear understanding of the events leading up to the incident.

Conclusion

The technology exists to create a more effective use of roading resources, introduce value-added services and enable more equitable collection of funds for road infrastructure maintenance and development.

The capital exists for the technology to be implemented in a manner that has no capital impact on government and reduces the real ongoing costs associated with collection of charges to pay for roading.

The organisational structure exists to enable the technology and capital to be deployed to revolutionarise New Zealand roading and to use technology to provide a superior result for New Zealand motorists, the New Zealand economy and the public in general.

The remaining question is whether the political will exists to allow roading to be fixed rather than maintain a problem that can be used to build public sector empires and for endless politicking.

Part 7 – The Challenge

There have been numerous attempts over the past decade to innovate in the area of roading. The Roading Advisory Group of 1997-8 considered the transfer of roads into State-Owned Enterprises and the charging of motorists for road usage. Transit New Zealand has since 2001 looked at road tolling as a method to access new sources of funds as an alternative to the central government's consolidated account.

However, these attempts have all been flawed for a series of common reasons:

1) The attempts at innovation have been instigated by the public sector to resolve a deepening political problem: the public dissatisfaction with the New Zealand roading infrastructure.
2) The public sector has a belief in its right and capability to solve the roading issue using internal skills and resources and has excluded the private sector from making any meaningful independent contribution to resolving the issue.
3) The New Zealand government has repeatedly dismissed the capabilities of the private sector's technological resources, innovative skills, organisational capabilities and financial flexibility in resolving the issues. Any attempts by the private sector to make these resources available are simply ignored.

The result is predictable: a risk-adverse and narrow-focus approach proposing solutions that fail to offer any advantages beyond strengthening the public sector's supposed ability to deal with the roading problem. It is hardly surprising that such solutions are met with cynicism by the public.

Indeed, the MoT road pricing proposal for Auckland is seen as merely the latest in a continuing round of like-minded risk-adverse and narrow-focus ideas to emerge from the public sector, and can expect substantial political opposition as it offers no real improvements to the current situation. In fact, it is a timid response with negative net economic benefits that fails to address the real issues related to roading.

Yet, there are alternatives. A bold alternative to the roading problem with substantial economic, social and environmental benefits and achieving the same policy objectives is available.

The New Zealand Government has been told for over eight years that a new roading network capability will be installed in New Zealand. This service has almost arrived. By 2008 it will be operating and the situation will be changed. The Auckland local bodies will have the option of introducing a road charging service from that time. There is not need to squander public funds on a technological obsolescent system.

It is time to get used to the fact that the private sector has its own ideas on solving the roading system, and through superior innovation, technology, organisational skills and financial resources, it is in a far better position to realise real advances than a risk-adverse, narrowly-focussed and technologically-challenged economic sector like the Government. It is time to cooperate instead of trying to dominate the future of New Zealand roading.