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Applying “Systems Intelligence” to Transport

A Presentation to the Annual Land Transport Summit, 2007, by Owen McShane, Director of the Centre for Resource Management Studies.

Background and Introduction

A Presentation in Three Parts

This is Part A of a three part written presentation to the Annual Land Transport Summit, 2007. Part B is “Halle Neustadt – the Sustainable City; a Cautionary Tale.” Part C is “Alternatives to Smart Growth.” I was asked to give this presentation only a few days before the conference opening and have not had the time to write a new paper to cover the whole topic. I have updated these three “parts” and my verbal presentation will combine the three into a hopefully coherent whole.

Sustainability – an unsustainable test.

For most of the many years during which I have been involved in transport issues, both traffic engineers and urban economists tested their transport investment decisions against an analysis of “net public benefit”. If benefits exceeded costs, then the project was worth doing, and the size of the ratio determined the priority of the project.

These days, the new concept of “sustainability” has entered the lexicon, and traditional benefit-cost analysis appears to be taking a back seat.

However, I submit that the test “Is it sustainable?” has little utility, if only because the term “sustainable” is undefinable, and hence means whatever anyone wants it to mean. Indeed, in my opinion, “sustainability” is so much in vogue only because it allows politicians and lobbyists to conceal their prejudices and preferences behind a multitude of “sustainable” smokescreens.

Of course I recognise that sustainable management, as in “the sustainable management of a forest or fishery” has meaning. Also “Sustainable Management” as defined in the Resource Management Act, with its focus on protecting the “life supporting qualities of the soil water

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and air”, provides a meaningful framework for decision making – if only this discipline was better observed.

However, I submit that catch-cries like “promoting sustainable cities” or “sustainable transport systems” have no clear meaning at all. As Professor David Henderson¹ explains, “sustainable development” is integral to the politics of “salvationism”. It encourages “wise leaders” to tell us we are living “unsustainable” lives, and they can then promise to deliver the key to “salvation” from our errant ways – if we only give them the necessary power.

We should resist the temptation because this is truly the 21st Century version of *The Road to Serfdom*.²

We Cannot Know the Future

When the late Karl Popper destroyed Marxist theory in his philosophical essay *The Poverty of Historicism*, his main argument was that we cannot predict future knowledge, and that therefore the future is unknowable. It is fair to assume that at any given time in the past, every economy has been ‘unsustainable’. But the advance of human knowledge has guaranteed “sustainability” in the past, provides “sustainability” today and ensures “sustainability” in the future.

Should we worry about all those “future generations”? Given that a child born today is likely to live to be a 100, those future generations are a long way in the future. We have enough to think about dealing with the needs and aspirations of current generations.

We have no idea of the needs and desires of generations more than a hundred years in the future and what technology will be available to them. They will also be much wealthier than we can dream of. And when do these future generations finally arrive?

¹ Global salvationism forms the main theme of Chapter 4 of his study, *The Role of Business in the Modern World: Progress, Pressures, and Prospects for the Market Economy*, published in 2004 by the Institute of Economic Affairs (London), the New Zealand Business Roundtable (Wellington) and the Competitive Enterprise Institute (Washington, DC). Outside and alongside the official world, and beyond the IPCC milieu, salvationist ideas and presumptions have found continuing support in influential scientific circles as well as from a wide range of non-governmental organisations (the NGOs). For further commentary go to: <http://www.staff.livjm.ac.uk/spsbpeis/David-Henderson.htm>

² Friedrich A. Hayek, *The Road to Serfdom*, Routledge Press, 1941. Has reached at least 50 editions. See: http://en.wikipedia.org/wiki/The_Road_to_Serfdom

The Human Success Story

The human population of the planet has risen from only a few individuals to several billion over the last couple of million years.

Technological advances, from the invention of fire, agriculture, the wheel and, more recently the wave of development associated with the industrial revolution, means that present generations are the best fed, longest-lived and healthiest of all people who have ever lived – and that includes the poorest nations.

Yet all resources are more plentiful and cheaper than they have ever been.

Those who claim this will not continue into the future must presume that we have suddenly, in these early years of the 21st century, run out of the ability to invent. Anyone who owns a computer should find it hard to believe that innovation has ground to a halt. Humans just love to invent. Human history is the history of invention – and we are getting better at genuine innovation every day. For example, nanotechnology seems about to hugely increase the efficiency of solar panels – with all that implies.³

Most importantly, the standard solutions to the “sustainability” problem appear to be backward looking. For example, “New Urbanism” is actually “Old Urbanism”. Motor vehicles are assumed to be “unsustainable” while trains are assumed to provide the bedrock for “sustainable development”. (See *Part B: Halle Neustadt – the sustainable city. A Cautionary Tale.*)

“Sustainable Transport” – back to the future.

Politicians and planners love to tell us:

“We have to get people out of their cars and on to public transport – especially on to trains.”

The politicians and planners may take heart from “widespread public support” but they don’t seem to realise the public is really saying:

“Get other people out of their cars so I can have more room on the road.”

The anti-car campaign is a hopeless cause because the private motor-car is simply the most effective, efficient and comfortable means of transport ever devised. We are NOT “addicted”

³ See Freeman Dyson’s stimulating and optimistic work *The Sun, the Genome and the Internet*. This 86 year old physicist’s predictions are a great antidote to the “doomcasters”.

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to our cars. We CHOOSE to use cars for the same reason secretaries use word processors, farmers use tractors, and we all use washing machines. In most circumstances, cars are the sensible choice.

We now have ample evidence that attempts to reduce congestion by boosting public transport are doomed to fail. From 1980 to 2000 the US increased its annual public transport subsidies by 133%. The end result was a 26% loss in public transport work-trip market share.

That's money well wasted.

Over the same period, solo-driving's work-trip market share increased by 18%.

There is no doubt that getting people out of their cars during peak hours can reduce congestion. We notice this during school holidays – although this reduction in inner-city congestion may be more due to working parents taking their vacations at the same time as school is out, rather than the drop in their actual trips to the school.

The first part of the “solution” – getting people out of their cars – may be a good idea. But the second part is now demonstrably wrong.

So why do the planners persist with such a lost cause?

Many of today's planners are urban romantics⁴ who steadfastly look to the 19th Century for solutions to 21st Century problems. Consequently, they completely overlook the several technologies which actually do get people out of their cars during peak hours, which can reduce congestion, and provide all the benefits claimed for traditional public transport – but which are seldom, if ever, delivered.

Their “sustainable” solutions are essentially backward looking and instinctively reject any sign of modernity. (David Willmot will cover much of this territory later in the programme so I need say no more.)

I wish to argue the opposite case. The future of our cities, and the future of the transport systems which provide mobility for their citizens, lie with the application of new technologies, and especially the application of our developing “machine intelligence” enabled by broadband wireless communications.

⁴ Owen McShane, Centre for Resource Management Studies, *The Rise of Urban Romanticism or The New Road to Serfdom*, June 2005.

See: <http://www.rmastudies.org.nz/documents/UrbanRomanticsUS.pdf>

Adaptability Requires Intelligence and Intelligence Delivers Adaptability

The IQ Test for Transport Investment

Rather than meddling with “sustainability” I suggest that when testing infrastructure investment decisions, we should ask whether this decision will promote and enhance the overall ‘intelligence’ and ‘adaptability’ of the system so as to enable further adaptability of the system as new technologies and systems come along.

The genius of life is that life adapts to change by evolving new life forms. The key to survival is adaptability and the reason human beings are so successful as a species is that our intelligence allows us to adapt more rapidly than evolutionary change processes would normally allow.

“Life” has much to teach us.

When we introduce this “transport IQ test”, we soon realise that new technologies can hugely enhance the intelligence and adaptability of “rubber on road” transport, but can do little to enhance the intelligence and adaptability of “steel on rail” systems. Rail is literally stuck in a “Low IQ rut” and cannot respond to real-time changes in demand, and other external signals.

Sadly, part of the appeal of rail is its simplicity and lack of complexity. Simple-minded systems appear to appeal to simple minds. (This argument was first developed by Jonathan Richmond in “The Mythical Concept of Rail Transit in Lost Angeles” in November, 1966. His findings are just as valid today.)

I shall now look at several emerging technologies and test them against their contribution to system “intelligence and adaptability”.

Some ‘IQ Enhancing’ Systems

General

First, the motor vehicle has been reasonably described as an engine on wheels. The private car was the real “iron horse” because unlike trams or trains the car delivered the main virtue of the horse – point to point mobility.

But all the signs are that the motor vehicle is about to be transformed into a “computer on wheels”. The next generation of cars will use high tech materials, use “drive by wire” and have a diverse range of engines available; many of them will be electrical.

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Their overall onboard intelligence will be hugely enhanced and these systems will make the car much safer. They will even park themselves as you walk away.

I have attached a few discussions of these possibilities as an appendix. These are just examples of what engineers are “Imagineering”. The reality will no doubt be quite different and probably even much more fun.

The Cell/Video Phone.

The cell/video phone is already contributing to system intelligence.

Already the video-phone is resurrecting “hitch-hiking” as a useful form of public transport, and this will carry over into increased use of car-pooling and ride-sharing as the power of the technology catches on.

When I was a student (and could not afford a car) hitch-hiking was a routine means of moving round the country. Later, when I first owned a car, I was willing to pick up hitch-hikers in return for the favours I had enjoyed a few years earlier. However, the risks associated with both picking up hitch-hikers, and with hitching rides, are now so great that I, like most of you I am sure, now refuse to take the risk.

For similar reasons we are reluctant to participate in spontaneous car-pooling or ride-sharing. This inhibits the effectiveness of car-pooling and ride-sharing as a means of reducing peak hour congestion in urban areas.

The cell/video phone increases security for all participants in “hitching” rides. As a car pulls up, the potential rider can photograph the number plate and, on climbing into the car, photograph the driver. Similarly, the driver can photograph the rider. Both images can be downloaded to appropriate data-bases and both parties are now secure – or as secure as any two people in a shared vehicle can be.

The GPS System

As cell phones and motor vehicles become integrated into the GPS system the location of driver and passenger can be tracked at any time, or more reasonably at the beginning and end of the ride, or whatever proves necessary as the system develops.

Broadband Internet.

Broadband internet allows images in full colour and considerable detail to be downloaded and communicated freely among diverse parties, and between central data collection and control systems, as required. The system also allows people to use a network of connections to scan

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large numbers of people on line to link up common plans and common destinations and bring drivers and travelers together. Soon, everyone with a car and a cellphone will be able to put “taxi-driver” on their CV.

Computer Based Dating Systems – DriveMe?

The cell/video phone, GPS systems, and broadband internet, can be combined in a host of ways (many not even thought of yet) to hugely increase the intelligence and adaptability of the “rubber on road” system. Twentieth Century improvements in the internal combustion engine, the drivetrains, and other mechanical systems, have hugely enhanced the performance of the internal operations of the motor vehicle over the last century. Twentieth Century improvements in the electrical and electronic systems have also hugely improved driver comfort and control. Driving a car, bus or truck has never been as comfortable, or as effective, or as efficient, or as cheap.

The integration of cellphone, GPS and Broadband into the motor vehicle fleet, during the 21st century, will enhance the intelligence and adaptability of “rubber on road” to a degree not thought of last century. The 21st Century will see the individual “insects” of the vehicle fleet transform into a communicating and coordinated “swarm” – bringing brand new benefits, efficiencies and opportunities.

The late Mel Webber, (Professor Emeritus of planning at U C, Berkeley, and former director of the University of California Transportation Center) once explained to me, back in 1969, that the real solution to “public transport” would come only when we figured out how to utilise the massive unused capacity of the fleet of private motor vehicles. That is about to be achieved. (Mel Webber edited *Access Magazine*, which is online at <http://www.uctc.net/access/access.asp#24>. His editorial of Spring 2004 was excellent.)

There are now several groups in the US working on the software and systems design needed to allow a pensioner in the countryside – no longer allowed to drive – to dial up and connect to someone nearby about to travel to their shared destination. The price could be \$3 or a bag of lemons, or a bottle of olive oil or whatever.

I call such schemes “PDP”, for “Pensioners Driving Pensioners”. One group of pensioners gets a ride – the others supplement their income.

Mel Webber wrote at <http://faculty.washington.edu/~jbs/itrans/webber.htm>:

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A merger of automobiles, telephones, cellular phones, radios, satellite locators, and computers could support new transit systems that are compatible with modern suburbs. Following Robert Behnke's lead, we envision computer-based dating systems that, in real time, would match drivers and potential passengers having the same origins, destinations, and schedules. A phone call to "Multi-Mode Transport Central" would permit residential neighbors with common destinations to fill some of those empty seats on any given day and hour, even though they're total strangers. The incentive to the passenger is a convenient trip by car at tolerable cost. The incentive to the driver is reduced travel cost and perhaps even supplemental income.

“DriveMe” would seem to be the obvious next project for “TradeMe”. I shall I say no more unless I pre-empt a patent.

Broadband and Telecommuting.

This ideal alternative to sole-driver commuting is called telecommuting, and it's being driven by broadband – the higher the speed the better. (See: The “*The Quiet Success: Telecommuting's Impact on Transportation and Beyond*” by Ted Belaker, of the Reason Foundation, at www.reason.org/ps338.pdf)

Since 1980, telecommuting is the only commuting mode, other than single occupancy driving, which has increased right across America. Telecommuting had the advantage of starting from a small base – but it had none of the public support and subsidies thrown at public transport.

The figures are startling. In San Diego, Dallas, and Phoenix, telecommuters outnumber all transit commuters. In Oklahoma City telecommuters outnumber all transit commuters by nearly five to one. In San Diego telecommuters outnumber light-rail commuters by 22 to 1 and in Denver by 47 to 1. Broadband supported telecommuting, unlike light-rail or other transit, requires no subsidies from ratepayers or taxpayers – and it works.

Broadband Telecommuting delivers real benefits. Public transport enthusiasts insist that public transport delivers a host of benefits which justify the massive extra costs and inconvenience. Copious evidence now demonstrates these benefits simply don't eventuate. In spite of massive subsidies and attempted social engineering, this massive wasted investment

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in public transport has no impact on fossil fuel consumption, greenhouse gas emissions, accident rates, air pollution, and peak hour congestion.

On the other hand telecommuting delivers solutions to all of these problems and more. When supported by high speed broadband, telecommuting improves mobility, reduces air pollution, reduces accidents, reduces fossil fuel consumption, increases “quality time” and leisure, and increases employment opportunities for the physically handicapped.

This same package, working in reverse, also improves access to health care by allowing top quality doctors, specialists and diagnosticians to operate from “virtually” anywhere. New Zealand’s pitifully slow uptake of broadband means we have barely begun to think about these potential benefits to our health system.

Many telecommuters have children at home. In the long term this may prove the most important benefit of all. In a recent *Opinion* piece in the *New Zealand Herald*, a young woman, studying to be a lawyer, expressed concern that while she wanted to marry and have children, the cost to her career would be massive because the time she would need to take off from work would set her back permanently. Her intention to raise a family would probably stand against her from the day she began her legal career.

The American experience suggests this is no longer true. A young woman can continue to pursue her professional career by telecommuting – either full or part time. Many American companies now regard a period of proven telecommuting ability a big plus on a worker’s CV. After all, telecommuting saves the employer costs as well, and proven telecommuters can be a useful resource when tendering for joint venture projects within different markets and countries. Telecommuters reduce the need to outsource to other countries because of their lower costs and higher productivity.

New Zealand needs men and women who are willing to raise children if we are to avoid the population collapse which is undermining the economies of Europe.

Telecommuting allows us to choose more “quality time”. Unions complain that our workers are spending more and more time at work and the quality of life, and of family life in particular, is suffering as a consequence.

Certainly, spending two hours every day commuting in rush-hour traffic, fretting and fuming, and wasting time and money, hardly contributes to anyone’s wellbeing. How many children go to school without lunch because their parents have had to get up so early “to beat the

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rush”? How many parents cannot afford school fees and books because of the money they spend on child-care and housekeeping services? Telecommuters can choose how to use their own time. It’s their choice.

Unions campaign for extra annual leave while employers complain of the extra costs. Typical telecommuters in America are gaining about 15 eight-hour days a year in actual extra time. These extra days come at no cost to the employer. Indeed Balaker quotes studies which find employers enjoy lower costs and increased productivity.

These savings are based on the measurable savings in commuting times. But telecommuters find other ways to save time – they shop at off-peak times and so enjoy easier parking and less time in check-out lines. They go to the gym when it suits, rather than on their way to and from work when everyone else does.

They also save real money. The typical telecommuter in Southern California saves as much as US\$1,200 a year in petrol money alone. They also save on expensive wardrobes, restaurant meals, hairdressing, makeup, child-care, and house care.

Telecommuting is the quiet revolution of our time. Given all these gains in so many areas, why do the benefits of telecommuting go largely unnoticed by planners and politicians alike?

We know that the central planners are more concerned with getting people into public transport than improving our lives. Politicians probably ignore telecommuters because they are dispersed, have no single voice, and are largely unaware of their own political power. Mainly, they don’t identify themselves as telecommuters.

Even those who stand most to benefit from telecommuting, like the young woman studying for her law degree, seem unaware of the opportunity which telecommuting, supported by high speed broadband, can offer to improve their quality of life and enhance their careers.

It’s time they spoke out.

HOT Lanes

Most Aucklanders will have heard of Bus Lanes, if only because our councils are promoting them widely and the Albany City Bus Lane is under construction.

Unfortunately, if urban transport agencies are promoting bus lanes it normally means they are social engineers rather than traffic engineers. They want their transport system to get people out of cars and onto public transport, even when people don’t want to make the change, and it provides no net public benefit.

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These “sustainable transport planners” have a “vision” of “bus lanes” in which buses stream along in glorious sole splendour, unhindered by other less virtuous vehicles, while those sinful private drivers sit frustrated in congested traffic lanes. They hope the drivers will finally become so jealous of the lucky bus passengers that “they will break their addiction to the motor car” – as though motor car drivers are the victim of some irrational illness and desperately in need of treatment.

Genuine traffic engineers promote mobility. Public transport can provide superior mobility for some, but has no intrinsic virtue. Genuine traffic engineers recognise too that taxis, shuttle buses, and aircraft make a major contribution to the public transport network, and do so without subsidy.

One way to get a “sustainable transport planner” foaming at the mouth is to talk about taxis and shuttles in the same breath as buses and trains. Taxis and shuttles are the “hidden” public transport providers and become more efficient and effective by the day. It’s time we started counting them.

Restricting a single motorway lane to buses only is a massive under-use of an expensive and valuable resource. Hence the US traffic engineers (who still tend to believe in mobility as a goal) call such lanes HOV (High Occupancy Vehicle) Lanes, and allow any vehicle with more than a set number of people to enter the lane free of charge. A few trial runs set the minimum number; in some locations it may be one or more passengers, in others two or more. The objective is to get full use out of the lane but without reaching 2000 vehicles an hour at which point the whole traffic stream will grind to a halt. The theory is that this provides a strong incentive to car-pool or ride-share.

However, research by Ted Ballaker in a recent *Reason* study on “Virtual Exclusive Bus Lanes”, indicates that promoting ride-sharing to ease peak-period congestion does not seem well-targeted and hence is marginally effective. Furthermore an article by Pravin Varaiya of UC Berkeley, in the Fall 2005 issue of *Access* titled “What We’ve Learned About Highway Congestion” concludes that even HOV lanes actually increase congestion.

Hence the more recent preference for **HOT (High Occupancy Toll) Lanes**. We will get more real value out of existing and proposed bus lanes by redefining and configuring them as HOT lanes, usable only by toll-paying vehicles (of whatever occupancy or engine type), or by “free-ride” emergency vehicles, and obviously high-occupancy vehicles such as shuttles and

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buses. This removes the need to count vehicle occupants, whether by hand or by new technology.

The most effective HOT lanes are those where high occupancy vehicles are allowed to enter free and any other vehicles may enter if they pay a “dynamic” load-responsive toll. The entry toll increases as the lane approaches the stall capacity of around 2000 vehicles an hour. At three in the morning a sole driver may not need to pay anything. But as traffic builds up at rush hour the toll cranks up until only the truly desperate will enter the lane. Hence if your wife goes into labour in the back seat, or you have to catch your plane, you may be prepared to pay \$30 dollars to guarantee an uninterrupted and 100 kph ride to your destination.

Most times you wouldn't.

The key to the HOT lanes is they run at maximum capacity for much of the day but never grind to a halt because dynamic pricing ensures they never reach gridlock loading. Notice too, that the tolls are set by an engineering based computer algorithm, not by a committee trying to divert passengers onto a loss-making bus or train service, or promoting other “social engineering” goals. The key to the success of the HOT lanes is dynamic demand-responsive pricing to control loading.

The Americans are building HOT lanes and they work. And the *Webber/Behnke DriveMe* systems will make them work even better.

The “Stockholm Syndrome” – Dynamic pricing of a system.

From January through July, 2006, Stockholm tested one of the world's most sophisticated traffic-management systems as part of a plan to reduce gridlock, lower smog levels and improve quality of life in the city. Unlike most other traffic-control plans already operating in cities such as London, Singapore and Rome, which use a fixed “CBD entry charge”, Stockholm used a dynamic pricing system in which drivers were charged different amounts depending on the time of day. Commuters leaving the city center at the busiest time of the afternoon rush, from 4 to 5:29, would pay the equivalent of US\$2.76. By waiting until 6:30 p.m., they traveled toll-free.

In the 1950s, Nobel-prize winning economist William Vickery theorized that billing drivers for driving at peak hours would give them an incentive to modify their routines. Because even small declines in the volume of cars on the road can have a huge impact on the flow of traffic, some economists believe pricing could dramatically enhance mobility.

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The Stockholm system, implemented by IBM in a contract with the Swedish national government, used small transponder boxes, laser detectors and a network of cameras to track the path of every car in the city. Each time a car passed through one of 23 tolling points, the system identified the car, either from its transponder or by reading the license plate. It then checked it against vehicle-registration information and calculated the appropriate fee depending on the time of day and location. A windshield-mounted transponder, similar to the E-ZPass in the U.S., enabled the tolls to be deducted automatically from drivers' bank accounts.

The experiment was turned off early last year, as planned, to see what happened and to give the people of Stockholm a chance to assess their total experience, before voting in the referendum which will determine whether the system is to become permanent.

Since then they have voted in favour of the permanent operation of the system. While it was off congestion increased and once it was turned back on congestion came down again.

This was a genuine experiment which has proved itself on the ground.

Like victims of the Stockholm syndrome, the Swedes had learned to love their tolls.

The system is "dynamic" in that it is a congestion charge, which varies with the time of day, rather than the fixed "commuter tax" already in place in London, Singapore and Rome.

However, the reports do not explain whether the charge is dynamic in the sense of responding to demand in the same way as the HOT lane systems. On the face of it, the Stockholm system appears to be "semi-dynamic" in that charges vary according to time of day, but are fixed for each time slot.

The Swedes are fond of their cars and their highway system but are also accustomed to switching modes because of the weather. An extensive underground rail system can operate under any amount of snow.

This will be an interesting experiment to watch because it applies the congestion charges to so many roads rather than only a few major routes. The technology package is powerful and could be developed further with experience.

Smart Card Ticketing – where trains do have a few brains.

Transport planners and traffic engineers are well aware (or should be) of the "tourist syndrome".

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Letter-writers to the Editors of major dailies frequently declare that they have just returned from Europe or Asia, or even Sydney, and used the trains all the time, and claim that if we had similar trains here in Auckland, they would use them here too.

I know that when I travel to those locations I, too, frequently use the trains, and certainly use them more than buses.

Where train systems operate my transport of choice is train, shuttle and taxi. Where trains don't operate my transport is by shuttles and taxis. Of course if I could take my car in a suitcase I would use my car.

Most casual tourists avoid buses like the plague.

The reason is that modern urban train systems have "foreigner friendly" high-tech ticketing systems. You can enter the lobby, stand in front of a machine, analyse your trip, and poke around in your purse or wallet for the right money (and currency), seek assistance if necessary, and even make a few mistakes because the machines are very forgiving. Once you have got the right ticket you can stroll through the turn-styles and drop your card in the slot, make your way to the platform and board the carriage, knowing it will take you where you plan to go. And you can do all this with all the confidence and aplomb of a born-and-bred Parisian, Singaporean, or whatever.

But it takes a brave person to climb on board a foreign bus. For one thing you have to speak to the driver, who may not speak the native language, let alone English. And you cannot be sure it's the right bus anyhow. And then you have no idea what change he will take or even how much it might cost, or even where to put it. And everyone else behind you grumbles about your "dumb tourist" behaviour.

However, we should recognise that this is no reason to build train systems in our own cities if the train system cannot perform. The intelligence of the ticketing machines represent just about the only passenger-oriented brain cells in an otherwise dumb "steel on rail" system.

Early train systems could afford these ticketing systems because they concentrate so many customers at the point of sale. Buses are much more decentralised (which is their advantage) but this requires many more machines at many more stops.

Solutions appear to be on the way. Again wireless broadband can link "slave" terminals to a central computer and reduce the local costs. A more likely development is the "smart" pre-paid plastic card, which you wave in front of a scanning machine once the driver has keyed in

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the destination or number of sections. Such smart cards solve the currency and coinage problems at one stroke.

These new ticketing technologies will increase the intelligence and adaptability of buses, taxis and shuttles – and deprive trains of their single “intelligent” lead.

Truck Lanes

Just about every day someone writes to the newspaper suggesting we replace two lanes of our urban road lanes with lines for light-rail. This is generally assumed to be “a good idea”, even though our City Fathers removed the original tram-lines with good reason some time ago. Light-rail carriages are just “swept up” trams after all.

On the other hand, any suggestion we should replace rail-tracks with roadbeds is greeted with outrage.

Certainly, the rail operators in the UK were outraged by the report by Paul Withrington, "Reigniting the Railway Conversion Debate" published by the UK Institute of Economic Affairs, June 2004. The abstract reads:

The economic functions of railways could be carried out by express coaches and lorries at one-quarter the cost of the train, using 20-25% less fuel, requiring one-quarter to one-third of the land, and imposing a casualty cost on passengers half that suffered by rail passengers. The railway conversion debate was initiated in the 1950s by the late Brigadier Lloyd and carried forward by the Railway Conversion League, subsequently renamed the Railway Conversion Campaign, until the death of its chairman, Angus Dalgleish, in 1994. The purpose of this paper is to reignite that debate. The government should remove all impediments to the conversion of railways to roads.

The UK railroaders should know better than to reject such findings out of hand – because good managers should be asking these kinds of questions, and examining these kinds of strategies, all the time.

Back in the mid-fifties, when the transistor was invented, the manufacture of vacuum-tubes was dominated by ten major suppliers. Twenty years later when the microprocessor was invented, the manufacture of transistors was dominated by ten top suppliers but only one manufacturer survived to remain on both lists. The top nine vacuum-tube manufacturers had failed to adopt the new solid state technology.

What were they thinking – or not thinking?

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Twenty years later companies like Sony and Akai switched from turntables to CD players, and from videotape to DVDs, without blinking. These companies had learned they were in the home entertainment business – not in the business of making turntables – and just grabbed the best technology for the job as it came along.

My analysis of the emerging transport technology suggests “rubber-on-road” will almost certainly displace “steel-on-rail” from the rail beds, just as gas turbines displaced pistons in aircraft. The next generation of trucks will “drive by wire” on these converted “rail corridors”.

The driver’s hands and legs will instruct the computer which will instruct the drive train and the hydraulic power systems. A guide-wire down the centre of the newly constructed road bed, laid over our present railway lines, will allow the computer steering system to keep the truck “on-line”. Truck drivers will drive their trucks to the shunting yard where they will leave them and drive away on an incoming truck to deliver its local load. These trucks will be mechanically and electronically connected into “truck-trains” driven by only one “driver” in the front cab, monitoring the performance of every truck in the train. At the next Station, trucks will peel off to be driven away, again by local drivers, to their local destination. The savings in labour costs will be immense. The coupled trucks will reduce drag. Accident rates will decline. Drivers will never drive far from home. Lots of short trips will replace lots of long ones.

Hardly any trucks would drive on the regular roads which would then require much less maintenance and be much safer for everyone. Tourists in particular will be much happier. The *AA Advocate* (Winter 2006) foresees massive on-road conflicts between huge numbers of logging trucks, milk trucks and foreign tourists. By 2030 the AA suggests every other driver on the highway could be a foreign visitor.

Sadly, it appears the current operators of the steel-on-rail trains won’t make the switch because, like the vacuum tube manufacturers of the fifties, they are committed to running their hardware rather than providing a service.

So when the first “truck train” calls into your local station it will be operated by a company with a name like Freightways or DSL. And a bundle of companies with names like X-track and Y-rail will disappear from corporate memory.

“Peak Oil” – The End of “Rubber on Road”?

The anti-car brigade are thrilled to bits by the prospect of “Peak Oil”. They claim there is no point in building more roads, because soon there will be no more oil, and hence all motor

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vehicles will grind to a halt, and we will all have to ride on public transport – which is evidently to be powered by rubber bands or windmills or some other green force.

The Green Co-leaders are arguing against building more roads, that further investment in aviation is plain foolishness, and Government should sell its shares in Air New Zealand. With empty tanks those birds won't fly. The Greens seem to forget that two thousand years ago the Romans built roads. They put them to good use and we still do.

Similar predictions have been made before. English industrialists worried they would run out of coal. The Royal Navy thought it would run out of timber spars. Machine makers thought they would run out of whale oil. Computer analysts worried they would run out of the copper to connect all the PCs. Paul Erlich was convinced that by now we would have run out of just about everything.

Fortunately, no one took any notice then. We should take no notice now.

It's true that for the last few decades the world has enjoyed incredibly cheap oil. Even though the wells are distant, refining is complex, and fuel is subject to massive taxes, the petrol powering your car is cheaper per litre than most bottled water – including New Zealand water.

Peak Oil theory claims we are using oil faster than we are discovering new supplies. We should not be surprised. Oil has been so cheap and plentiful (two ways of saying the same thing) that it has not been worth looking for more of it.

Much of the oil in known reserves needs a higher price to make it worth extracting. Some is "taxed" by environmental restraints. Now that prices are high the oil companies are exploring again. Governments are providing the appropriate incentives.

The US uses only half the oil per unit of production that it did in the mid-seventies. The vehicle fleet is hugely more energy efficient, and grows more efficient by the day. The latest SUVs use computer controls to automatically switch from V8s to V4s in cruise mode, so the high power is delivered only when needed. Electric hybrids can more than double fuel efficiency.

Oil is one source of energy, but only one. If oil gets truly expensive the future will still be awash with energy because so many new sources are waiting in the wings – they just need oil to get more expensive. New energy sources are all around us.

All energy is nuclear. Solar energy is nuclear. Geothermal energy is nuclear.

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Gravity originates in the nucleus. Hydro-dams combine solar energy with gravity. So do the tides and so does the wind.

Coal stores old solar energy. Oil stores old geothermal power and gravity. This may come as a surprise because we have been taught that oil and gas, like coal, are fossil fuels. But *Chevron* has recently found oil at a depth of 28,000 feet – far too deep for any organic hydrocarbons. This find would appear to confirm Thomas Gold's theory that at least some oil and gas is the result of hydrocarbons trapped deep in the earth, oozing their way to the surface and even being continually "manufactured" by high pressure and high temperatures deep in the earth's crust. If so, natural gas (although probably not oil) may be virtually unlimited.

(See <http://mitosyfraudes.8k.com/INGLES-2/FossilFuels.html>)

The Earth is awash with nuclear power from the sun. There are scores of ways to tap into it and so our future will be awash with energy, while oil, gas and coal will give us time to make the transfer.

But surely, eventually, the oil must run out.

No – the oil will never run out. No natural resource ever runs out. Once there were only two of us. Now there are over six thousand million of us, and yet no mineral resource has ever "run out". As any mineral or similar resource gets scarce the price increases until it is not worth using, and substitutes step in from where they have been waiting in the wings.

Sometimes new technologies simply sweep the old ones aside. We switched from sail to steam – but we hadn't run out of wind.

But let's concede the era of ludicrously cheap oil may well be over, and that the next round of oil will be more expensive because it will be more difficult to find and to extract. What happens, for example, when petrol hits, say, \$5 a litre at the pump? At that point it is worth converting coal into fuel oil using present technologies. Well before that happens, converting or modifying other oil-like reserves, and using more expensive forms of natural gas becomes worth while. New Zealand sits in the middle of an "ocean" of natural gas, including "frozen methane" offshore.

Waste-to-energy plants can produce electricity and new technologies can turn waste biomass directly into oil. Windmills on your house roof might dissociate water into hydrogen for the fuel cell in your car. Physicist Freeman Dyson predicts that genetic engineering will soon make trees and plants much more efficient at capturing solar energy. Carter Holt may grow

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GM forests to burn as biomass. Dyson also predicts the development of plants which produce fuel oils directly from their roots. Every garden will have its high octane corner. The Alberta oil sands contain the equivalent of 1.6 trillion barrels of oil, maybe more than all of the world's oil reserves combined. A higher price will turn much more of this resource into a reserve.

Cell phone technology will assist the electrification of the motor vehicle fleet – cellphone battery technology is progressing in leaps and bounds and the lead-acid battery may soon be displaced with much more efficient batteries or super-capacitors.

A shrewd guess is that a bunch of new technologies will allow us to stabilize around a plateau of supply and demand which delivers petrol at about \$2.50 per litre. That's twice the current price, but if your new electric hybrid motor car delivers twice as many kilometers per litre you will be no worse off.

This more expensive fuel oil will be directed to aircraft and to motor vehicles where it delivers the most benefits. Electricity generators will switch to nuclear fuel, coal and useful renewables such as solar power, geothermal energy, wind and biomass.

Finally, we will be able to afford even higher prices for our cars if we need to.

The average household income for the Auckland Region is about \$66,000 dollars a year. After a hundred years GDP growth at say 3% a year their income will be over a million dollars a year. They could afford to pay \$30 a litre to fill their tank.

So don't panic. Oil will be around for a long time. And so will cars and planes. However, the oil-age will certainly end before we run out of oil.

Just as the stone-age ended long before we ran out of rocks.

Owen McShane
September 7, 2006, revised February 16, 2007.

APPENDIX

Moore's Law and Luxury Transportation

Moore's Law (stated by the famous founding CEO of Intel) claims that the density of semiconductor circuitry doubles roughly every 18 months.

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Today's cars differ from those of the immediate post-war years on a number of counts. But suppose for a moment that the automobile industry had developed at the same rate as computers and over the same period, how much cheaper and more efficient would the current models be?

Today you would be able to buy a Rolls Royce for \$2.00; it would do three million miles to the gallon, and it would deliver enough power to drive the Q. E. II.

And if you were interested in miniaturization, you could place half a dozen of them on a pinhead.

Given that Moore's Law still holds these 28 years - 19 doubling periods of 18 months each - after 1978, I wonder how the above statement would be formulated today? A quick calculation is that you would have to multiply, or divide as appropriate, each of the above comparison items by a factor of 524,000.

Who Needs A Driver? – The driverless bus you hail with your mobile

Ian Johnston

A model of a futuristic "driverless" bus that promises to cut air pollution and traffic congestion was unveiled at the Science Museum yesterday.

The state-of-the-art vehicle will use the latest technology to navigate the streets, using magnets embedded in the road as markers.

Passengers will be able to hail a bus or "pod" using their mobile phone to pick them up from a specified location, to take them to a chosen destination. The bus has been developed by leading bus engineering designers Capoco Design in collaboration with the Royal College of Art.

Alan Ponsford, Capoco's lead designer, said the pods would carry between 12 and 24 people and several could run together on main routes, before splitting up and going into residential areas. It could run along fixed routes but also work out the best and most efficient route for picking up and dropping off passengers based on their route.

He said: "The bus goes along sniffing out magnets in the road which tell it exactly where it is, so it can redirect itself to pick up passengers."

Mr Ponsford said each automated bus has satellite navigation and intelligent cruise control, as well as onboard systems to control speed and direction and avoid hazards.

Designers claim the bus, which is an electric drive and bio-fuel hybrid,

will be cheap to run, with the lack of driver reducing operating costs by up to 50 per cent. The bus will also use 50 per cent less energy than ordinary buses and 85 per cent less than cars.

A prototype is due next year and Mr Ponsford said the system could be available commercially in about three years. He said: "There will be a significant period of introduction, with the first trials run in a closed community such as Heathrow Airport. Then it will be tested in other communities."

If trials are successful, the bus could be ready to work alongside other modes of transport in cities within ten years.

However, Mr Ponsford admitted there were some problems to be overcome: a driverless vehicle at a French theme park ran over and killed a sleeping dog on the route and the sensors were subsequently re-set.

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A pile of leaves might prove a difficult obstacle for sensors to assess, but if the pod stopped, a central controller would be able to use a camera on the front of the bus to make a decision whether it was safe to proceed.

A spokesman for bus drivers union, the TGWU, said he could see a place for driverless buses, but doubted drivers would become a thing of the past.

"Any impersonal service that has all the hallmarks of 1984 or Brave New World, I think is going to take a long time to be accepted," he said.

This article: <http://news.scotsman.com/uk.cfm?id=91192007>

Toyota's Range of "Future Concepts".

http://www.toyota.com/vehicles/future/highlander.html?s_van=GM_HOME_HIGHLAND

This link connects to a Toyota web page which links to its nine future/concept vehicle pages. The vehicles are based on its hybrid synergy and all-electric drive systems.

The nine "concepts" are one collection of Toyota's vision of the future in vehicles and personal transportation. They all require roads.

Toyota plans to use carbon fiber to reduce weight to provide additional efficiency. The 0-60 mph acceleration is in the four-second range. Boeing is using carbon fiber in its new 787 Dreamliner commercial airplane. Boeing found that carbon fiber is stronger than the metal used in its previous airplanes.

By extracting carbon from power plants and other sources, carbon feedstock can be made for use in many products including vehicles. So there would be little need to sequester carbon in the Earth as envisioned. That would be a waste.

Moreover, these very efficient and CO₂ free vehicles could obviate the need for expensive, heavy and obtrusive light-rail trolley systems while providing point-to-point transportation service for people. Hybrid buses and busways would provide more flexibility at less cost than LRT. This too would open the way for specialized, fast and above-it-all elevated monobeam cantilevered-monorail systems (see www.monorails.org tech pages) to complement car and bus roadways less obtrusively.