Intelligent Transport Systems
Master Plan

International Trends
Focus Paper
February 2014
## Contents

1. Introducing the Master Plan and Discussion Paper ........................................... 2
2. Why look at International Trends? ........................................................................ 2
3. Changing Role of a Road Authority ................................................................. 2
   3.1 The Big Shift .................................................................................................. 2
   3.2 Fiscal Constraints ......................................................................................... 3
   3.3 More from Less ............................................................................................. 3
   3.4 Implications for Main Roads ........................................................................ 3
4. Intelligent Infrastructure ....................................................................................... 3
   4.1 Managed Freeways ...................................................................................... 3
   4.2 Managed Arterial Roads .............................................................................. 7
   4.3 Intelligent Transport Networks ..................................................................... 7
5. Smarter Vehicles .................................................................................................. 7
   5.1 Automated Vehicles .................................................................................... 7
   5.2 Connected Vehicles ..................................................................................... 8
   5.3 Cooperative Vehicles and Infrastructure .................................................... 8
   5.4 Implications for Main Roads ........................................................................ 9
6. The Growth of Big Data ....................................................................................... 10
   6.1 Why is data becoming “big”? ..................................................................... 10
   6.2 How to extract value? ................................................................................ 10
   6.3 More personalised and effective targeting of individual services .............. 11
   6.4 Dynamically match capacity to demand ..................................................... 11
   6.5 Improved asset management ...................................................................... 11
   6.6 Implications for Main Roads ....................................................................... 11
7. Increased Private Sector Traveller Information ................................................ 12
   7.1 Open Data .................................................................................................... 12
   7.2 Increased Private Sector Involvement ......................................................... 12
   7.3 Beyond Traveller Information .................................................................... 12
   7.4 Rural Traveller Information ....................................................................... 13
   7.5 Implications for Main Roads ....................................................................... 14
8. Other Views on the Future of Technology in Transport .................................... 15
   Digital-Age Transportation: The Future of Urban Mobility (Deloitte) .......... 15
   Disruptive technologies: Advances that will transform life, business, and the global economy (McKinsey Global Institute) ......................... 15
   Self-driving cars: The next revolution (KPMG and the Center for Automotive Research) ............................................................. 16

Feedback and Questions ........................................................................................ 16
1. Introducing the Master Plan and Discussion Paper

Main Roads is preparing an ITS Master Plan as part of our 2020 Strategy; the Discussion Paper which this International Trends report accompanies is the first step in preparing that master plan. The Discussion Paper seeks to start the engagement with both internal and external stakeholders and to lead into collaborative discussion sessions.

2. Why look at International Trends?

Our world is changing, and we need to adapt to these changes. There are new challenges but also new opportunities. This focus paper chapter explores five of the international trends most applicable to a road authority and the growing use of technology for more intelligent transport. These international trends are not only happening overseas, in the large markets of North America, Europe and Asia, they can also be seen clearly within Australia.

For each of the trends it is important to look not only at what is happening but what that might mean. This chapter covers both and intends to spark conversation with stakeholders about what lies ahead and how best to adapt to its challenges and to exploit opportunities.

3. Changing Role of a Road Authority

3.1 The Big Shift

Over recent years, road and transport authorities around the world have been adapting to the big shift in their purpose. Road authorities such as Main Roads were originally established to construct and maintain a road network. Although some road expansion continues, the network has significantly matured and the focus has moved towards facilitating transport use of the network. This big shift focuses attention onto how the community and the economy benefit from the use of the transport system and the service it provides.

Figure 3.1 – The “big shift” towards operations of the road network (source: adapted from VicRoads)
3.2 Fiscal Constraints

Governments around the world are facing increasing fiscal constraints. In Western Australia, expenditure growth is continuing to outpace revenue growth, forcing the government to reconsider its business model. Funding for roads is unlikely to increase in line with increasing demand from economic and population growth or the increased costs resulting from ageing assets being increasingly intensively used.

3.3 More from Less

The shift in focus to facilitating transport services combines with the fiscal constraints to create a strong need to do more from less. This focus is sometimes referred to as “sweating the asset” as is not unique to road networks, with big miners such as Rio Tinto adopting a similar approach to respond to tighter market conditions.

Increasing the productivity of our transport assets to provide more from less can benefit our road users through reduced travel times, more reliable travel, improved safety and a better road user experience. Initiatives in this space will often but not always feature technology, and do often require the right capability, resources and processes to achieve full benefit.

Finances are not the only constraint driving a need to do more with less. Increasing scarcity of land, changing community expectations and a renewed focus on productivity all contribute to the need to achieve more throughput (i.e. number of vehicles or people being carried through) per lane per hour.

3.4 Implications for Main Roads

Main Roads has started its journey towards extracting greater performance from the road network as part of its response to increasing congestion. This builds upon the existing foundations, already deployed ITS and long-established adaptive traffic signal system

Specific actions that would contribute to achieving more from less include the following:

- Implement active management of urban freeways (Managed Freeways)
- Reviewing the operation of arterial roads to improve efficiency
- Increased focus on measures to prioritise road use (support TransPriority)
- Continue to improve management of incidents, and planned roadworks and events

Achieving more from less will also be supported by improved information to road users and leveraging the potential of more intelligent vehicles – more on this in the following trends.

4. Intelligent Infrastructure

A key part of road agencies’ response to the challenges of managing increasing demands on transport networks has been through the move towards actively managing infrastructure to get more from the transport network.

4.1 Managed Freeways

Managed Freeways (also known as Managed Motorways) is a widely used smarter infrastructure approach to increase the productivity of freeways in order to move more people and freight whilst reducing travel times and improving safety and reliability. Managed
Freeways is a ‘tool kit’ of traffic management and ITS which are implemented to deliver benefits to the road user, the economy and the environment.

Managed Freeways aim to make the best use of the existing freeway network, particularly during times of high demand or incidents. This is through the achievement of sustained and safe utilisation of the full productive capacity of the asset. Dynamic network management and operation in real-time (or near real-time), when supported by appropriate mainline and ramp geometric improvements, allows the road authority to optimise freeway traffic conditions.

The Managed Freeways ‘toolkit’ includes a range of ITS treatments and operations strategies such as coordinated ramp signalling, isolated ramp signalling, lane use management enabling full pavement utilisation on a full-time or part-time basis (i.e. emergency lane running), variable speed limits, roadside traveller information and incident management systems. These treatments also require the deployment of ‘intelligence’ services such as vehicle detectors and surveillance camera systems, as well as foundation infrastructure such as power and communication networks and the central control system.

The ability of better use initiatives such as managed freeways to leverage lost productivity of the existing infrastructure is highlighted by the figures in Table 5.1 below. The 27% increase in the productive use of the asset comes through addressing the inefficiency that happens from stop-start traffic reducing throughput at the times when demand is at its highest.

<table>
<thead>
<tr>
<th>Freeway Productivity (3 lane carriageway)</th>
<th>Unmanaged Freeway</th>
<th>Actively Managed Freeway</th>
<th>Increased Productivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freeway flow range (peak)</td>
<td>4,950 – 6,150 (persons / hour)</td>
<td>6,450 – 7,500 (persons / hour)</td>
<td></td>
</tr>
<tr>
<td>Freeway flow average (peak)</td>
<td>5,550 (persons / hour)</td>
<td>7,050 (persons / hour)</td>
<td>+ 1500 (27% increase)</td>
</tr>
<tr>
<td>Utilisation of service capacity (max 2400 persons / hour / lane)</td>
<td>78%</td>
<td>98%</td>
<td></td>
</tr>
</tbody>
</table>

*Table 4.1 – Productivity improvements from active management*

In addition to well-known examples in Australia, New Zealand, the UK and the Netherlands, Managed Freeways are used in many other countries. Figure 5.2 below shows an example from Italy featuring a complex signage arrangement for lane use and speed management on a popular freight route.
In Perth, significant development work has been undertaken and is continuing on Managed Freeways. This development work has provided not only proposals and business cases for consideration by government, but also a suite of policy and operational resources to assist successful future implementation and operation (see Figure 5.3).

**Figure 4.1** Managed Motorway in Italy (source: [www.skyscrapercity.com](http://www.skyscrapercity.com))

**Figure 5.3** Managed Freeways Policy and Guidelines Framework for Western Australia
Ramp Signals

Ramp signals are one of the most powerful tools in the Managed Freeway toolkit, however the nature of how they achieve benefits is less immediately apparent than some other tools.

Ramp signals manage access onto the freeway, using traffic signals on the on-ramps to balance the flow of entering freeway traffic and help traffic to enter the freeway safely and easily. The signals receive traffic data on current freeway conditions in real time from sensors that are placed under the road surface at both the on-ramps and on the freeway. Working in coordination with other ramp signals, their purpose is to keep the freeway moving and work to avoid the conditions where stop-start traffic forms. By doing this, they help drivers merge more easily and keep more vehicles moving more efficiently along the freeway. By keeping the freeway flowing and helping to move more people, ramp signals allow more traffic to enter the freeway at ramps across the network, not less.

Ramp signalling is particularly prominent in the US, where since the 1960s over 4000 ramp signals have been implemented in more than 20 cities across 15 states. This rollout continues at a rapid pace; in California alone, 342 ramp signals were installed in 2012 and 2013, to add to the 2460 existing ramp signals with a further 1642 new ramp signals still planned.

The most notable example of a community debate on ramp signals occurred in Minnesota in 2000, where the state legislature mandated a six-week shut down of the 430 ramp signals. This period was used to undertake an independent assessment on the benefits that the ramp signals provided, with Cambridge Systematics finding that switching off the ramps signals:

- Reduced freeway throughput by 9%
- Increased freeway travel times by 22% and decreased travel time reliability by 91%
- Increased freeway crashes by 26%

Following the six week shut-down, the ramp signals were turned back on and have remained on since. Some modifications were made to operational parameters to provide a more balanced focus, and the lessons from this Minnesota study have been applied internationally including within Australia.

International post-evaluation reviews of ramp signals back up the Minnesota experience, including in nine other US locations, Melbourne, Auckland and the UK.

Within our region, ramp signals are being rolled out across most large cities. In Melbourne, 62 ramp signals sites installed as part of the M1 Upgrade are being added to through the M80 Upgrade and other Managed Motorways projects. In Brisbane, existing ramp signals have been switched to dynamic operation with more new sites planned and in Sydney, planning is well progressed to roll out ramp signals to the M4 Motorway.

---

2. [http://www.dot.state.mn.us/rampmeter/study.html](http://www.dot.state.mn.us/rampmeter/study.html) accessed 3 February 2014
3. [http://www.topslab.wisc.edu/mwg-internal/de5fs23hu73ds/progress?id=3TmmVNoX94](http://www.topslab.wisc.edu/mwg-internal/de5fs23hu73ds/progress?id=3TmmVNoX94) accessed 3 February 2014
4.2 Managed Arterial Roads

The recent focus on Managed Freeways might suggest that arterial roads are lagging behind for advances in active management. The reality however is simply that the provision of dynamic, adaptive control over the arterial road network started gaining momentum in Australia in the 1970s and 1980 whereas most freeways remain without such control.

Across Western Australia and most of the rest of Australia, traffic signals operate on SCATS (Sydney Coordinated Adaptive Traffic System), an adaptive control system that adjusts the cycle length, splits of green time and coordinates intersections. This is a powerful tool already in place and so many recent efforts on better managing arterial roads have focussed not on providing new tools, but rather of making better use of the existing tool. This is important work, but work which involves little new visible infrastructure for road users to view as signs of process.

Other more active management of arterial roads through ITS involves the increasing use of speed limits tailored to conditions, such as electronic speed limit signs with reduced limits for school zones and shopping centres.

4.3 Intelligent Transport Networks

The trend towards more intelligent transport is not limited to roads. In urban passenger rail, the adoption of more advanced Automated Train Control methods is being actively considered in Sydney and Melbourne to increase capacity to between 24 and 30 trains per hour to increase the passenger carrying capacity of existing rail lines. In longer distance rail, the Australian Rail Track Corporation (ARTC) is developing an Advanced Train Management System to improve rail network capacity, operational flexibility, train service availability, transit times, rail safety and system reliability.

Port terminal facilities are also becoming increasing automated to increase capacity whilst improving safety and reducing operating costs.

These improvements across each element of transport networks contributes to an overall better performing transport network and more efficient supply chain for businesses reliant on transport. To date many of these intelligent infrastructure technologies have been focussed within a particular transport network or mode. Over time we can expect to see this evolve into more intelligent intermodal transport networks.

5. Smarter Vehicles

5.1 Automated Vehicles

Vehicle technologies are rapidly improving, and this will have a significant impact on road use. The initial community benefit from smarter vehicles will be in the area of safety, as we have seen already with ABS braking and electronic stability control.

There is a wide spectrum as to what automation means for vehicles, from warning systems through to driverless vehicles. The US National Highway Traffic Safety Administration

(NHTSA) has proposed definitions that distinguish between different levels of automation. These can be found in Table 1 below.

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
<th>Examples</th>
<th>Implication</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>warnings but no automation</td>
<td>lane departure warning, blind spot warning</td>
<td>the driver is in full control but supported by systems</td>
</tr>
<tr>
<td>1</td>
<td>function specific automation</td>
<td>electronic stability control, adaptive cruise control</td>
<td>the driver is always driving but safety systems take some corrective action</td>
</tr>
<tr>
<td>2</td>
<td>combined function automation</td>
<td>combined adaptive cruise control and lane keeping assistance</td>
<td>the vehicle can operate without driver inputs in some conditions (eg. rural highway cruise)</td>
</tr>
<tr>
<td>3</td>
<td>limited self-driving automation</td>
<td>in normal conditions vehicle can operate autonomously, but hands back control to driver at short notice in some conditions</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>full self-driving automation</td>
<td>vehicle operates without requiring driver input; vehicle may or may not have a driver present</td>
<td></td>
</tr>
</tbody>
</table>

Table 5.1 Automated Vehicle Level Definitions, adapted from NHTSA

The requirement for electronic stability control on all new passenger cars in Australia means that some level of automation is already prescribed. Some other level 0 and level 1 technologies such as blind spot warnings and adaptive cruise control are becoming increasingly common on new vehicles. An increasing number of new vehicles already have an ability to operate in a level 2 mode in some conditions, particularly rural driving.

5.2 Connected Vehicles

In addition to vehicles having increased capability to assist drivers maintain safety, there is rapid growth in improved entertainment and connectedness to information. As a road authority it is tempting to think of this primarily in terms of increased access for drivers to traveller information, however for consumers, infotainment and internet access are at least of equal interest. This increased functionality provides a clear risk for driver distraction; this issue is already being seen with a proliferation of devices like DVD players within vehicles and regulations have been modified to try to keep pace.

5.3 Cooperative Vehicles and Infrastructure

Vehicle connectedness means having a link to the outside world while travelling on the road. Cooperative vehicles go a step beyond this, to having focussed communication with other vehicles on the road and with the road infrastructure so that all can move around more safely and efficiently.

Vehicles that can communicate with each other can avoid collisions and form efficient platoons that increase effective capacity. By communicating with infrastructure, they can be advised of things such as a red-light ahead to brake in time and pass back information on traffic and infrastructure conditions.

US Policy Decision for Vehicle to Vehicle Communication

On 3 February 2014, The US Department of Transportation’s National Highway Traffic Safety Administration (NHTSA) announced that it would begin taking steps to enable vehicle-to-vehicle (V2V) communication technology for light vehicles. Details of what the next steps will be are not yet clear, however this commitment builds upon a long-term investment by the US government in investigating and supporting the development of connected vehicles and infrastructure, including the Safety Pilot “model deployment” in Ann Arbor, Michigan, where nearly 3,000 vehicles were deployed in the largest-ever road test of V2V technology.

Some implementation challenges remain, however the technology for cooperative vehicles and infrastructure is rapidly becoming mature. Car manufacturers have clearly communicated to the ITS community that they stand ready to deploy this technology, but that such deployment may proceed slowly unless regulation mandates its provision.

In recognition that Australians will benefit from a uniform national approach, Austroads is leading work in Australia for Cooperative ITS (C-ITS). This includes work to secure the 5.9 GHz radio frequency spectrum required for some cooperative safety applications.

5.4 Implications for Main Roads

The growth of increasingly intelligent vehicles offers considerable opportunity, but poses many questions for a road authority such as Main Roads. These include:

- If automated and cooperative vehicles can almost eliminate crashes from occurring, what does this mean for vehicle design (size and weight for safety in crashes) and

---

roadside infrastructure used to control traffic? If vehicle design changes, what are the impacts for design standards?

- During the extended period where vehicles of very different technology capability levels are on our road network, at what point will benefits start to become realised from some of these technologies?
- If during congested traffic a driver in an automated vehicle can be doing other activities within the car, what does this mean for the assumed value of time and the cost of congestion?
- How will driver distraction be managed if drivers are allowed to divert their attention at some times but their full attention is required at others?
- If fully automated vehicles can serve your trips on demand and come to your call without you having to be in them, what does this mean for usage patterns, parking locations, vehicle ownership and demand for private vehicle travel and other transport modes?
- What will increasing in-vehicle technology mean for the need to provide roadside infrastructure such as signs (static and electronic) and traffic signals and detection?
- What will the impact be during the likely protracted period where an ever reducing number of vehicles is solely reliant on the roadside infrastructure (without in-vehicle support) yet the costs of providing and maintaining that roadside infrastructure remain in full?
- If cooperative vehicles permit safe operation with reduced headways and hence increase capacity, what will this mean for our future network operation and our approach to planning for the future?

6. The Growth of Big Data

The growth of Big Data is a trend that extends beyond transport. It can be something of a nebulous concept, so let us first examine what it means in this context.

6.1 Why is data becoming “big”?

Broadly speaking, three things are happening to data relevant to transport to make it “big”:

- Volume – an increasing number of interactions with the transport system have some data collected about them
- Variety – these pieces of data may be in non-traditional forms
- Responsiveness – in a more connected world, more data is available live and people’s expectations have shifted towards expecting the benefits of this

6.2 How to extract value?

The existence of Big Data represents an opportunity; however the burning question is how to best benefit from this opportunity. This value creation occurs through the analysis and use of Big Data to do something better than was previously possible. This is a critical point – Big Data becomes valuable only when it helps Main Roads to do something better than previously; this requires not only the data but also the analysis to transform it into valuable information.
6.3 More personalised and effective targeting of individual services

The analysis of Big Data can build up pictures of how individuals use the transport system. Transport is a derived demand, meaning that people normally travel in order do something and rarely for travel’s own sake. This means that the individual patterns of use of the transport system are closely tied to broader patterns of individual activity, including how people make consumer choices.

6.4 Dynamically match capacity to demand

These richer patterns of individual activity and travel provide some insight into travel demands, the capacity required to serve those demands and the levels available to influence demand to a pattern better suited to available capacity. The greatest value from this opportunity exists in circumstances where this is flexibility to adjust capacity, for example additional targeted public transport services, or flexibility to influence demand, for example variable pricing.

Some of these situations already exist in the transport sector, for example demand-responsive public transport in some cities overseas and the high variability in airline pricing associated with yield management. For road authorities, further work would be required in order to introduce this same flexibility for capacity and demand management into road network management.

6.5 Improved asset management

In addition to directly instrumenting assets to collect condition data, a growing proportion of the vehicle fleet are capturing information that may assist asset management. Feedback from vehicle suspension systems can help build a picture on pavement condition and data from vehicle stability and braking systems likewise for surface friction and skid resistance. This data is less detailed than that collected by specialised monitoring vehicles but is potentially available in much greater volumes.

Information from navigation systems can also assist to build up a picture of what parts of the network remain accessible after major natural disasters; probe vehicle data was used to identify which roads were passible following the 2011 East Japan earthquake and tsunami.

6.6 Implications for Main Roads

One clear opportunity arising from Big Data is for Main Roads to reconsider how we collect data and what may be accessible at lower cost through alternative methods. In many cases a much larger volume of data will be available through other sources than through direct collection, however it will be different in nature. Such data is less likely to meet any exacting requirements for specific detailed information but may also open up other possibilities such as an understanding of an individual's activity chain in which travel occurs.

Leveraging Big Data is unlikely to come without cost or effort and as a result should focus on opportunities where there is high probability of achieving savings and/or added value. The most likely situation is one of evolution; where Big Data largely augments and extends Main Roads’ existing data collection and analysis activities.
A question for Main Roads will be the extent to which it is preferable or practical for Main Roads to directly hold these large and growing data sets and to run the analytical tools and methods that provide useful information from this data as opposed to purchasing processed information from others.

7. Increased Private Sector Traveller Information

One of the things driving this is the integration of traveller information into other things, for example the display of travel times on the popular Google Maps product, the inclusion of live information for GPS navigation and the use of traveller information within logistics management and dispatch systems. For all these uses a stand-alone traveller information product is not enough and this trend is likely to continue.

7.1 Open Data

Governments across Australia are moving towards Open Data, with Western Australia and Tasmania the two Australian states yet to have a formal portal for Open Data. An open data approach means that the data which the government holds is made available to the community for use, both to provide value-added services and to support transparency in government. It is the opportunity for value-added services which is of most interest for traveller information and this is an area where Open Data and Big Data may work together to reshape the traveller information ecosystem.

7.2 Increased Private Sector Involvement

Private sector involvement in traveller information has been increasing for a number of years, both with respect to collecting travel condition information (such as travel times and incidents) and in disseminating this to road users. For many years, travel bulletins on radio were a primary source of information for road users and this has now been supplemented with information accessed through the internet (desktop and mobile devices) and personal navigation systems.

This increased private sector involvement combines with the Big Data trend to create a changed environment where government must consider what role it best plays in this sector to facilitate maximum value for individual road users and broader community benefit.

Main Roads has already partnered with the private sector in providing traveller information. Main Roads provides real-time traffic signal control data (SCATS data) to a private company who synthesises that data with data from other sources such as real-time GPS data from probe vehicles and mobile phones to derive real-time speeds and travel times on road segments. Main Roads then receives this information back as real time data and historical data. Real-time data received in this manner is used to provide current travel times on the Gateway WA Project (via roadside mounted portable VMS and on a web-based map). Historical data is used for network performance analysis and monitoring purposes.

7.3 Beyond Traveller Information

A more recent trend in traveller information services is the integration of this information into other purposes and applications. A mobile device may now look at the appointments in your calendar to work out where you next need to be and your best option to get there, without

you even needing to ask the question. Logistics and dispatch systems can incorporate real-time conditions information into route optimisation and vehicle selection to improve service and lower costs. This trend is likely to continue as will demand for multi-modal information. There may still be a role for individual mode and purpose traveller information, however for the government to make the best of its investment we need to recognise these broader trends.

Figure 7.1 An example of traffic conditions integrated into calendars and schedulers

### 7.4 Rural Traveller Information

Travellers in rural areas also benefit from many of the new traveller information services offered but also have their own set of special requirements. There are unique challenges in providing timely road and traffic condition information to road users in rural and regional areas, particularly in States such as WA with extensive areas with less dense road networks, thinly scattered population and sporadic communication and power networks in regional areas. Roads becoming impassable due to severe weather events or incidents is a known challenge in these remote areas.

Main Roads has been focusing on regional traveller information for several years. We have implemented a floodway monitoring and traveller information trial in the Kimberley Region to enable real-time detection of flooding and implementing road closures/opening through remotely controlled signs. The lessons learned from this trial will be used in any further deployment of the system elsewhere.

Main Roads has recently worked with ARRB Group to complete a Feasibility Study and Concept of Operations for Regional Traveller Information. This study has identified and assessed all feasible options for regional traveller information and developed a decision making framework to guide selection of appropriate traveller information dissemination tools for individual locations.

Following on from this study, Main Roads is undertaking a proof-of-concept trial for disseminating real-time traveller information using telematics, in partnership with Transport Certification Australia. This trial will involve real-time dissemination of road and traffic
condition information via in-vehicle units on freight vehicles in the northern parts of the State and in Northern Territory. The Northern Territory Departments of Transport and Infrastructure are also participating in this trial as observers.

7.5 Implications for Main Roads

As the traveller information ecosystem changes, so does the approach for Main Roads to deliver best value to the community. There is increasing access to privately collected data, both raw and analysed. This data has its limitations but it may extend or replace more traditional sources, with data fusion applied to improve overall quality. The changing methods of disseminating traveller information open up new opportunities for more personalised and effective information to inform and influence travel choices. Main Roads approach to traveller information needs to fit within the broader transport portfolio and be guided by a new strategy which seeks to benefit from the opportunities of this changing environment.

Figure 7.2 Private sector traveller information data collection has progressed to the point where private companies are reporting on network performance of their own initiative (source: www.tomtom.com)
8. Other Views on the Future of Technology in Transport

This focus paper summarises trends in transport technology that are most relevant to Main Roads. These trends are seen widely as having importance, and an increasing number of leading global organisations are publishing reports and white papers on their views of the future. This section provides a summary of some of these reports for those interested in finding out more.

Digital-Age Transportation: The Future of Urban Mobility (Deloitte)

This report is accessible at http://dupress.com/articles/digital-age-transportation/

According to Deloitte, the transport of the future will be:
- Massively networked, with ubiquitous connectivity throughout the system
- Dynamically priced, so as to balance supply and demand
- User centred, taking into account users’ needs, priorities, data flows, and dynamic responses to conditions
- Integrated, so that users can move easily from point A to point B, regardless of mode, service provider, or time of day
- Reliant on new models of private-public collaboration, which take advantage of the increasingly diverse ecosystem of public, private, and non-profit entities that are working to meet the mobility challenges of the 21st century

The trends highlighted in this Main Roads focus paper cover a number of the enablers necessary for this future of transportation.

Disruptive technologies: Advances that will transform life, business, and the global economy (McKinsey Global Institute)

This report is accessible at http://www.mckinsey.com/insights/business_technology/disruptive_technologies

McKinsey identified 12 technologies that they believe term as disruptive due to their likely transformative impacts on society and the economy:
- Mobile internet
- Automation of knowledge work
- The internet of things
- Cloud technology
- Advanced robotics
- Autonomous and near-autonomous vehicles
- Next-generation genomics
- Energy storage
- 3D printing
- Advanced materials
- Advanced oil and gas exploitation and recovery
- Renewable energy

Many of these technologies will have some impact on the future of transport, however it is autonomous and near-autonomous vehicles that are the most directly related to the services provided and functions performed by Main Roads.
Self-driving cars: The next revolution (KPMG and the Center for Automotive Research)


KPMG and CAR believe that we are on the cusp of revolutionary change. To explore this area, they examine:

- Market dynamics and the social, economic, and environmental forces that are making change inevitable,
- The ongoing convergence of the key enabling technologies,
- The path to widespread adoption of advanced automated driving solutions, which we believe will take place in stages, leading over time, to reliance on increasingly autonomous or “self-driving” vehicles, and
- The social, political, and economic implications of self-driven automobiles and their impact on the entire automotive ecosystem.

The review of these aspects of automated vehicles has contributed to the context of the trend in this Main Roads focus paper on the future of smarter vehicles.

KPMG have since undertaken a follow-up report into readiness for the move into automated vehicles, Self-driving cars: Are we ready? This follow-up report is accessible at http://www.kpmg.com/US/en/IssuesAndInsights/ArticlesPublications/Documents/self-driving-cars-are-we-ready.pdf

Feedback and Questions

If you have any feedback or questions about this focus paper or the ITS Master Plan, please contact either:

Kamal Weeratunga  
Network Operations Planning Manager  
(08) 9323 4348  
kamal.weeratunga@mainroads.wa.gov.au

Tom McHugh  
Manager Road Network Operations  
(08) 9323 4810  
tom.mchugh@mainroads.wa.gov.au