Introducing the ‘FreightSync Roadmap’

Linking Road Freight Data and Traffic Management Systems

FINAL INDUSTRY REPORT, PROJECT 3.73

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Karlson ‘Charlie’ Hargroves, Professor Bela Stantic,
Dr Darcy Allen & Ben James.

Sustainable Built Environment National Research Centre AUSTRALIA

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Research Team

Project Leader and Lead Researcher

Dr Karlson 'Charlie' Hargroves – *Curtin University Sustainability Policy Institute, Curtin University*

Research Team

Professor Bela Stantic – *Director, Big Data and Smart Analytics Lab, Institute for Integrated and Intelligent Systems, Griffith University*

Dr Darcy Allen – *Blockchain Innovation Hub, RMIT University*

Ben James – *Curtin University Sustainability Policy Institute, Curtin University*

Project Steering Group Chair

Ken Michael – *Former Governor of Western Australia*

Project Steering Group

Mike Lopresti and Graham Jacoby – *Main Roads Western Australia*

Alizanne Cheetham, Carole Theobald, Alison Bunbury, Fabrice Gregoire, Tom Hoffman, Christopher Sharples – *WA Department of Transport*

Sue Hellyer, Dominique Thatcher, and Chris Crowe – *Fremantle Ports Authority*

Warren Jennings and Jamie Smith – *Telstra*

John Gordon and David Rowe – *Transport Certification Australia*

Vic Regina, Caroline Azolini, and Brett Graham – *Transport for NSW*

Dylan Moody – *QLD Transport and Main Roads*

Sam Marks – *Australian Trucking Association*

Tammy Wigg – *National Heavy Vehicle Regulator*

Chris Jones, Chris Egger and Zenon Pogorzelski – *National Transport Commission*

Gary Dolman and David Mitchell – *Bureau of Infrastructure, Transport and Regional Economics*

Susan Harris and Stacey Ryan – *ITS Australia*

Charles Karl – *Australian Roads Research Board*

Andrew Rankine – *Port of Brisbane*

Mark Taylor – *Hesperia*

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Message from the Chair

“This particular research was about linking road freight data with traffic management systems in real time to improve network outcomes. The greater interaction between road freight data a traffic management systems gives the opportunity for industry benefits to be realised, such as reduced trip times, reduce fuel consumption, and enhancing congestion management. This is the seventh project in the series where transport management is being examined through the introduction of new technology and policy initiatives. Looking ahead this legacy will provide opportunities for matters that are yet to be explored and for benefits that are yet to be realised.”

Ken Michael, AC
Chair
Project Steering Group
Former Governor of Western Australia

Preface

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We encourage you to draw on the results of this applied research to deliver tangible outcomes for your operations. By working together, we can transform our industry and communities through enhanced and sustainable business processes, environmental performance and productivity.

John V McCarthy AO
Chair
Sustainable Built Environment National Research Centre

Dr Keith Hampson
Chief Executive Officer
Sustainable Built Environment National Research Centre

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Executive summary

Given the high value of freight there has been much attention paid to ways to increase the efficiency of freight movement, with Infrastructure Australia estimating that transport and logistics contributes 14.5 per cent of GDP[1]. Initial efforts largely focused on detecting freight vehicles as they approach traffic lights, much like emergency vehicles, in order to improve overall vehicle flow[2]. Results suggest however, that despite some localised improvement it is likely that last minute detection will actually have a detrimental impact on the effectiveness of system wide signalling[3]. Hence, unlike the movement of a small number of emergency vehicles across an entire city, this approach may not deliver benefits when applied to freight vehicles across a transport network, calling for a more dynamic approach, one that will involve new forms of data exchange and the use of advanced analytics.

A number of government agencies, industry bodies and research institutions are producing public freight related datasets, however these often focus on highly aggregated historic data rather than real time tracking data held by freight and logistics companies. The linking of data from freight vehicles with traffic management systems stands to provide a number of benefits. These include reducing congestion, improving safety, reducing freight vehicle trip times, informing alternative routing for freight vehicles, and informing transport planning and investment decisions. There are a number of different methods to detect, classify, and track vehicles, each having strengths and weaknesses, each with different levels of accuracy and associated costs. Technology in this space is advancing quickly, having started with a focus on road-side sensors and communications devices and shifting quickly to GPS and mobile devices.

The findings of the first stage of the research as part of this project suggest that it is likely there will be two main forms of data collection required, namely:

1) Data with ultra-low latency and near-real time transfer, such as collision avoidance and safety applications, likely using vehicle-to-vehicle and vehicle-to-infrastructure systems, and
2) Data with small delays, such as data for traffic management which initially may be sourced from roadside equipment but will likely shift to mobile devices in vehicles in the near future.

[1] IA (2018) 'Australia's growing freight task: Challenges and opportunities', Infrastructure Australia, 31 October 2018.

[2] Kari D., Wu G., and Barth, M. (2014) 'Eco-friendly freight signal priority using connected vehicle technology', IEEE Intelligent Vehicles Symposium; Ioannou, P. (2015) 'Design and Evaluation of Impact of Traffic Light Priority for Trucks on Traffic Flow', University of Southern California.

[3] Zhao, Y. and Petros, I. (2016) 'A traffic light signal control system with truck priority', IFAC-PapersOnLine, vol. 49, no. 3, pp. 377-382, May 2016.

A key learning is that in order to be effective at the network level such data collection needs to go beyond spot detection of freight vehicles, often moments before they arrive at an intersection, to include not only current location and potentially classification, but also the intended route and destination of the vehicle. The research found that there are three main barriers to the collection of such data, namely:

- *Under appreciation of benefits:* Given it is early in the process to link vehicle generated data to traffic management and planning, there is currently a low level of appreciation of the tangible benefits to both freight operators and transport network managers.
- *Overcoming a reluctance to share data:* A key barrier is the willingness to share private data with government agencies due to concerns about how it may affect competitive advantage or that it might be used for punitive purposes.
- *Current capacity of traffic agencies:* Current traffic management systems are not yet equipped to process near-real time data in order to provide network-wide benefits. Efforts are underway but access to data to test such systems remains a hindrance to progress.

This report presents a strategic approach, developed in close consultation with industry and government agencies, to transition over time to mutually beneficial exchange of freight vehicle data with transport agencies. The approach, the “FreightSync Roadmap”, as shown in Table 1, is designed around a trusted intermediary in order to provide assurance that data will be used only as allowed, with initial efforts focused on demonstrating mutual benefits to both expand the level of exchange and the capacity of transport agencies to harness such data.

The goal of the FreightSync Roadmap is to achieve the seamless exchange of data between freight vehicles and transport systems in such a way as to deliver mutual benefit while ensuring the data is only used for agreed purposes.

The purpose of the ‘FreightSync Roadmap’ is to provide a pathway that outlines key steps involved in transitioning from the current situation where freight vehicles are largely invisible to traffic management, to a situation where the entire transport network is managed with full view of freight (and other heavy vehicles) allowing benefits to be created well beyond ad hoc responses. The intention of the FreightSync Roadmap is to inform and streamline collaborative efforts to accelerate progress to achieve this goal.

Table 1: *The FreightSync Roadmap*

	STAGE 1 **Understand the Landscape**	STAGE 2 **Plan the Approach**	STAGE 3 **Deliver Early Benefits**	STAGE 4 **Roll-Out Data Exchange**	DESTINATION
Track A: *Freight Operators - Data Collection*					
Tasks	Understand current situation, expectations and benefits	Map out approach to data collection and storage	Create initial cohort of participants with compatible systems	Automate active industry wide participation	Freight operators autonomously synchronised with transport system to reduce trip times
Outcomes	Identify specific risks and rewards from data exchange	Configure and provision data collection	Improved conditions on specific routes at specific times	Feedback from transport system	
Track B: *Freight Observatory - Data Curation*					
Tasks	Understand constraints and expectations	Map out approach to data exchange and privacy	Create value from exchange to support wider data exchange	Automate and expand seamless data exchange processes	Manage seamless data exchange between freight operators and the transport agencies
Outcomes	Identify preferred performance criteria and structures	Configure and provision data exchange platform	Expanded data exchange to include additional participants	Improved access to other heavy and shared vehicles	
Track C: *Transport Agency - Data Analytics*					
Tasks	Understand opportunities and implications	Map out approach to using live data in data analytics	Create mutual value from initial cohort of data	Automate real time data analytics and reporting	Real time synchronisation of freight vehicles with transport agencies for mutual benefit
Outcomes	Identify current processes that can be enhanced	Configure and provision real time data analytics	Improved outcomes to support roll-out of data exchange	Improved modelling, evaluation, and traffic management	

Introduction

It is important for the movement of freight vehicles to be effectively managed as this can deliver benefits for transport agencies, private sector logistics companies, and the road using public. Better freight management reduces congestions, leading to less pollution and a range of direct and indirect economic benefits,[4] and if done effectively can balance the needs of traffic management systems (such as preventing bottlenecks and reducing congestion) while delivering tangible benefits to freight companies. Given the need for data standardisation and increased interoperability,[5] a key consideration is to seek to minimise the costs to transport agencies associated with appropriately accessing and utilising real-time freight data.

At first glance, this seems to be best done by direct access to freight operators' data as many freight vehicles are equipped with GPS and Mobile Network technologies, however, in practice this raises a number of questions, including how the data will be used and if it's worthwhile to the company to release it. If such a direct method cannot be achieved then there are a range of non-vehicle options, each with benefits and short-comings, as outlined in Table 2. For instance, the detection of freight vehicles can be done using technologies such as roadside cameras and sensors, along with areal and satellite imagery.

Table 2: *Summary of strengths and weaknesses of non-vehicle options for vehicle detection, classification, identification and tracking.*[6]

	STRENGTHS	WEAKNESSES
Infrastructure based Technology Options		
Aerial Imagery (Object detection and vehicle classification)	• 80% accuracy for object classification. • System can deliver a range of functions along with vehicle identification.	• Requires senders and receivers to be installed roadside.
Wi-Fi System (Object detection and vehicle classification)	• Provides detection and classification. • Provides 82% accuracy for object classification.	• Uses satellites and may have up to 10 minute latency. • Early stage technology.
Infrared Traffic Logger (Object detection and vehicle classification)	• Mature technology with >98% accuracy. • Non-invasive, versatile deployment, minimal power and servicing. • 25+ year life, resists weather conditions.	• Requires on-site installation of physical unit at each monitoring point. • Dated software compatibility. • Limited networking capability.
Bluetooth System (Object detection and vehicle speed)	• Well established technology with decent travel time detection. • Avoids requiring permission.	• Requires receivers installed roadside, typically in traffic signal control boxes. • Detects 10-15% of vehicles.
Video Analytics - Object (Object detection and vehicle classification)	• Existing cameras with 96% accuracy. • System can deliver a range of functions along with vehicle identification.	• May require additional multiuse roadside cameras to be installed.
Video Analytics - Plate (Vehicle identification using number plate recognition)	• Can use existing cameras with 98% accuracy for vehicle identification. • Can be linked to vehicle information.	• May require additional multiuse roadside cameras to be installed. • Privacy considerations for authorities.

[4] ALC (2018) 'ALC Brief - Inquiry into National Freight and Supply Chain Priorities', Australian Logistics Council.

[5] Hargroves, K., Stantic, B., and Conley. D (2016) 'Big Data, Technology and Transport: A Sustainable Built Environment National Research Centre (SBEnrc) Industry Report', Curtin University and Griffith University, Australia.

[6] Hargroves, K., Shirley, D., Seppelt, T., Callary, N., Tze Wei Yeo, J. and Loxton, R. (2020) 'Overview of Options to Collect Vehicle Generated Data to inform Traffic Management Systems', Project 3.73 – Road Freight and Network Efficiency, Sustainable Built Environment National Research Centre (SBEnrc), Australia.

Table 3: *Summary of strengths and weaknesses of on board options for vehicle detection, classification, identification and tracking*[7]

	STRENGTHS	WEAKNESSES
On-board Technology Options		
GPS Trackers and Telematics (vehicle tracking and identification)	• Location data accurate under clear sky conditions to a 5-metre radius. • Can be linked to vehicle information. • Roadside equipment not required.	• Requires device installed on vehicle. • If a private device is installed there may be a reluctance for data to be made available to transport agencies.
GPS Digital Licence Plates (vehicle tracking and identification)	• Provides location data using GPS that can be linked to vehicle information. • Allows changeable display. • Roadside equipment not required.	• Requires device installed on vehicle. • Management by licencing authority. • GPS may cease working if number plate is hit or damaged.
RFID System (vehicle tracking and identification)	• Provides location data that places vehicles in the read range. • Can be linked to vehicle information. • Can be integrated with object tracking system.	• Requires device installed on vehicle. • Requires receivers to be installed roadside (avoiding metal surfaces). • Tracking can only be done with adequate roadside receivers.
Weight Sensors (vehicle weight)	• Provides real time load information rather than requiring a weigh-bridge. • Can allow prioritization based on actual weight rather than vehicle type and length.	• Requires device installed on vehicle. • Requirement for a communication system to export data. • Requires calibration and maintenance to ensure accuracy.
Dedicated Short Range Communications (vehicle detection)	• High Speed reliable data transmission. • Standardised frequency across the equipment, reducing costs.	• Requires device installed on vehicle. • Technology a low level of maturity. • Short range capabilities only.
Mobile Network Communications (vehicle tracking and identification)	• Allows two-way communication. • Readily available, low-cost, non-specialised technology.	• Requires mobile device on-board. • Signals from other mobile devices may interfere with data transmission.

[7] Hargroves, K., Shirley, D., Seppelt, T., Callary, N., Tze Wei Yeo, J. and Loxton, R. (2020) 'Overview of Options to Collect Vehicle Generated Data to inform Traffic Management Systems', Project 3.73 – Road Freight and Network Efficiency, Sustainable Built Environment National Research Centre (SBEnrc), Australia.

Despite some impressive functionality as part of the options provided in Table 2, it is clear that the non-vehicle option has limitations in terms of effectively tracking heavy vehicles and understanding likely destinations. Hence a system reliant on roadside detection means that freight vehicles are likely to remain invisible to the system, with operators left to use third party apps in order to navigate traffic. When considering on board options there are again a range of choices, as summarised in Table 3, which can be used to access real time data. The findings of the research suggest that the use of dedicated short range communications between vehicles for safety outcomes, and the use of mobile networks to connect vehicles to the traffic management system, stand to be the most effective methods.

However, before such exchange can be possible a number of concerns need to be addressed, such as:

- *what is the benefit to freight operators?*
- *who will have access to the data? and*
- *how will it be used? For instance can the data be limited to use only by the transport agency or will it be open to use by enforcement agencies?*

Why develop a FreightSync Roadmap?

What does the term 'FreightSync' mean?

The reason a Roadmap is needed to inform efforts to link freight vehicle data and transport systems is because although tracking technology is now widely available, the combination of the technology and analytics needed to harness the data to improve traffic management is in its early stages of development, and trust will need to be established through novel collaborative deployment initiates.

This means that there will be a need for new partnerships between the freight industry and transport agencies that may call for the nomination or creation of new intermediaries or supporting systems. Given the exchange of data stands to benefit both the freight sector and the transport agencies, there needs to be strong buy-in from the early stages to ensure that key issues are resolved, such as access and privacy, with the associated initiatives needing to be well informed and strategically deployed.

A 'Roadmap' is a strategic pathway to guide the implementation of a series of concurrent activities, divided into a set of stages, in order to deliver a number of preferred outcomes. Having said that, a Roadmap is not intended to perfectly predict the best way forward, but rather to provide a unified approach that can be used to inform and align agile efforts over time.

> *The term 'FrieghtSync' has been chosen to describe the exchange in real-time of specific data between freight operators and transport systems for mutual benefit.*

As such this functionality is intended to not only inform real time traffic management but to also contribute to historic data sets that are used to inform transport planning and infrastructure decisions. An important consideration is how to deal with data security to ensure that firstly the data being exchanged is secure, but also that it is only being used for purposes that have received consent.

What is the value of a FreightSync approach?

It is important when considering a new way for data to be exchanged in an industry to clearly understand the associated benefits and beneficiaries, namely:

- *Likely benefits for Freight Operators:* Currently freight operators navigate the transport system much like any other road user, using third party traffic applications that provide an indication of the level of congestion and expected trip times. This approach provides benefits as it allows areas of high congestion to be avoided and trip times to be compared to job requirements. However, such a passive approach misses the opportunity to interact with the traffic management system directly. Given freight vehicles influence vehicle flow rates, the more the transport system knows about their movements the better it can manage traffic.

  In short, the benefit of appropriately exchanging data with transport agencies is that both daily traffic conditions and longer term transport planning outcomes can be improved, such as:

  a) *Improved Traffic and Transport Planning Outcomes:* Providing access to information on freight vehicles, including classification, location and destination, can improve traffic flow conditions across the network, such as via responsive signalling to manage cycle times and offsets and other adaptive traffic management methods. Such data will allow traffic management systems to understand both current and near future behaviour of freight vehicles allowing for tailored traffic responses and evxen direct communication with freight vehicles on preferred routes and timings. Along with short term traffic management benefits, in the longer term data exchange can improve transport planning decisions and associated investment.

  b) *Direct Benefits to Operators:* Apart from benefits to traffic management there are a range of other benefits for operators, such as: automated clearance for road access for various vehicle classification types; improved vehicle flow at loading points; informing freight forwarders of anticipated level of driver promptness; consistency across state borders; and linking freight tracking with container parks, rail services, and port stevedores to improve synchronisation.

c) *Positioning for Future Benefits:* Such a system of data exchange would position the sector well to take advantage of a range of future digital productivity options. For instance, as outlined in SBEnrc 'Project 1.64: Exploring the Potential for Artificial Intelligence and Blockchain to Enhance Transport',[8] using emerging digital distributed ledgers can deliver new value to the logistics sector, such as:

   – *Verifying Authenticity:* The ability to provide access to secured proof of origin and sourcing evidence for a range of high-value goods, such as wine and other exports.

   – *Streamlining Transactions:* The ability to have multiple transactions along a supply chain transacted on one permissioned database to share customs releases, commercial invoices, cargo lists, broker loads, etc.

   – *Optimisation:* Once established such systems would provide a rich pool of information for Artificial Intelligence to optimise freight routes, staging and storage of freight, and inform the potential for sharing of facilities and avoiding running empty.

- *Likely benefits for Traffic Management:* Near real time data on freight vehicles can be beneficial to traffic management systems in a number of ways, including:

a) I*mproved Signalling:* Improving signalling to account for the presence of freight vehicles across the network (rather than at an intersection by intersection basis) allowing improved network capacity by pre-empting increases in freight vehicle frequency.

b) Vehicle Communication: Informing freight vehicles of preferred routes to encourage use of parts of the transport network with lower congestion levels, this may also include providing freight vehicles with target speeds to reduce likelihood of meeting a red light.

c) *Enhanced Safety:* Alerting inappropriate road use by restricted access vehicles to increase safety, providing the location and progress of dangerous goods movement, and informing the designation of gazetted routes and timings based on actual freight movements.

d) *Real-time Monitoring*: Identifying trouble spots with intersections or bottlenecks in traffic flow that may warrant investigation and intervention, and allowing monitoring of actual bridge crossings to compare to strength assumptions of bridges.

e) *Predictive Analysis:* Inferring driving patterns of vehicles to include typical acceleration speeds, breaking distances, etc. to predict future behaviours, and informing predictive analytics by comparing real-time conditions to historic data to predict the likelihood of congestion events.

f) *Streamline Data:* The benefit of such as system would be to streamline access to data and reduce duplication, with the data observatory aggregating and curating the data.

- *Likely benefits for Transport Planning:* Building a database of tracking data on freight vehicles will be a valuable source of information to create a record that shows where the freight load is being transported across the transport system. Such a level of detail on freight vehicle movement will provide a much clearer view of vehicle behaviours and can generate a range of benefits. This type of data is typically gathered using periodic surveys that may not be repeated for a number of years, or by making assumptions, such as the percentage of freight and other heavy vehicles in traffic flows, with both options proving little indication of time of use patterns. Having a real time stream of such data can allow a comparison between the quality of the road system and the quantity of freight carried at particular times (especially high value freight) which can influence decisions as to where to invest in infrastructure betterment and upgrades.

[8] Hargroves, K., Stantic, B. and Allen, D. (2020) 'Exploring the Potential for Artificial Intelligence and Blockchain to Enhance Transport – Final Industry Report', Sustainable Built Environment National Research Centre (SBEnrc), Australia.

How could a FreightSync System function?

The FreightSync Roadmap focuses on both developing an appropriate framework for the exchange of data, and increasing the capacity of freight operators and traffic management systems to harness the data for mutual benefit.

- *The appropriate exchange of data:* In order to implement the FreightSync Roadmap a critical issue to overcome is to ensure that data exchanged between freight operators and transport agencies is secure and can only be used for the expressed purpose, which is achieved by going through a trusted third party such as Transport Certification Australia (TCA). TCA receives data from freight operators to assess compliance for various government agencies with the data provided under consent agreements that prohibit use for any other purpose unless as part of a legal requirement such as a court order. This trusted third party role is a critical part of the compliance process as it allows government agencies to confirm non-compliance without receiving access to the data. For the purpose of the FreightSync Roadmap we refer to the trusted third party as a 'Freight Observatory'.[9]
- *The increase in technical capacity:* It is important to understand that the deployment of on-board technologies in freight vehicles is not uniform. Larger freight operators that carry an estimated 80 percent of freight and represent say 10-12 percent of the 42,000 road freight companies in Australia are likely to be well equipped, however the remainder are typically reliant on mobile devices to access traffic information.[10] Hence, if the intention is for data to eventually be collected from all freight vehicles, a staged approach is needed to first work with the companies with such technologies to demonstrate the early value that can be created, and then expand to other vehicles. Furthermore the need to increase the technical capacity of traffic management systems must also be considered. Such systems are likely to not yet be equipped to process real time tracking and destination data from heavy vehicles and use this to inform traffic management or transport planning, although a number of transport agencies have developed programs in this area.

Considering this, the FreightSync Roadmap has three main stakeholders, each with a different role, as shown in Figure 1.

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[9] DIRDC (2018) 'Inquiry into National Freight and Supply Chain Priorities, Report', Department of infrastructure, Regional Development and Cities, Canberra, ACT.

[10] NTC (2016) 'Who Moves What Where - Freight and Passenger Transport in Australia', National Transport Commission.

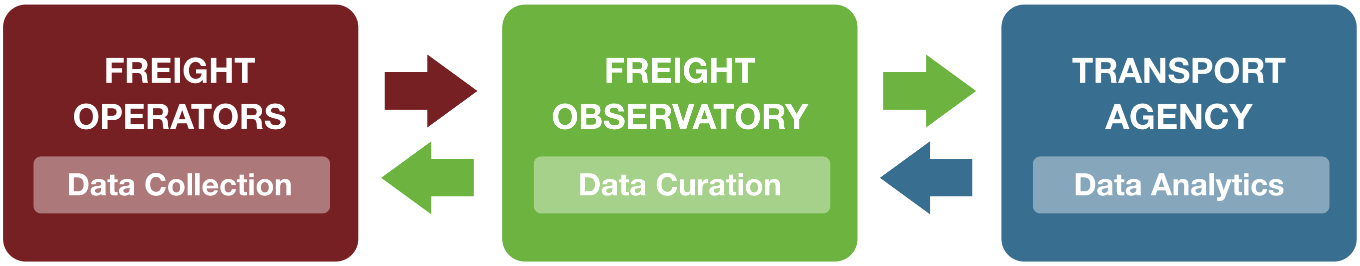


Figure 1. *FreightSync Data Exchange Flow Chart*

The first set of stakeholders are the freight operators (and telematics service providers) that will be tasked with collecting data on freight vehicles and receiving data from the traffic management system. The second is the trusted ‘Freight Observatory’ that will be tasked with curating data from multiple sources and making it available under agreed conditions to the transport agency. The third is the transport agency that will undertake data analytics and modelling to improve the overall traffic flow and provide direct guidance to freight operators.

What is the potential for wider application?

Many of the benefits available are also relevant to other large and heavy vehicles such as buses, shuttles, garbage trucks, cement trucks, etc. Hence should the FreightSync Roadmap lead to the deployment of such technologies it could be made available for wider application. This is of particular interest given that due to growing congestion issues many cities around the world are now seeking to shift away from private vehicle dominant transport infrastructure to shared rapid-transit corridors serviced by bus and shuttle services. Also, in addition to other applications, there is the potential to integrate with new functionality such as digital distributed ledgers that are increasingly being used to track freight to not only significantly reduce transaction costs but to provide a trusted source of authenticity and providence.

[11] Newman, P., Hargroves, K., Davies-Slate, S., Conley, D., Verschuer, M., Mouritz, M. and Yangka, D. (2019) ‘The Trackless Tram: Is It the Transit and City Shaping Catalyst We Have Been Waiting for?’ Journal of Transportation Technologies, 9, 31-55.

FreightSync Operational Considerations

How can consistency be achieved?

When considering the development of a new approach that is set to involve multiple stakeholders – in this case numerous freight operators, some form of freight observatory, and transport agencies – it is important not to re-invent the wheel and identify existing language and frameworks that can form part of the supporting structure. For instance a key existing framework administered by the Transport Certification Australia (TCA) is the 'National Telematics Framework' which provides a central platform for telematics related technology, applications and data queries, namely:[13]

1. A 'Telematics Data Dictionary' that sets a common understanding of data types, formats and definitions.
2. A set of standard methods and mechanisms for the transfer of telematics data between entities.
3. A set of governance frameworks to manage privacy requirements, to ensure the use of data collected through telematics and related technologies is used only for disclosed purposes.

What type of data is involved?

There are two categories of data on freight vehicles; firstly data that is suitable for public use (such as averages and trends), and secondly data that is not suitable for public use (such as real time location and intended destination of particular trucks). It is likely that the first category is suitable for curation by a government agency for use by researchers, companies and government agencies, such as the National Freight Data Hub.[14] However, it is the latter category that is the focus of this report as it is not clear how to best curate and analyse such data in order to allow it to be used by the transport system for mutual benefit, with the following data likely to be involved:

1. *Vehicle Classification:* Vehicle classification will inform assumptions by the transport agency around anticipated dimensions such as height, width and length, along with the maximum weight without identifying the particular vehicle. The footprint of the vehicle is important for traffic management as it will have queuing and signalling implications. Data may also include the commodity classification (ATFCC) and the pack classification (APC).

[13] TCA (2018) 'National Telematics Framework: A Digital Business platform', Transport Certification Australia Limited.

[14] Productivity Commission (2017) 'Data Availability and Use: Overview & Recommendations', Report No. 82, Canberra.

2. *Location:* This data can be used to create updated historic data sets of overall freight vehicle movements along with providing real-time locations. The release of real time data may be restricted to a notification when the truck arrives at an intersection along the route to the nominated destination (or a geo-fenced portion of the route) rather than along the entire trip (which may give access to acceleration, speed, braking data that may not be part of the consent agreement). In this case the traffic system knows that a truck is at a specific set of lights now and it is heading to a set destination, so it can select a likely route based on roads that can be used and traffic conditions and then verify as it moves progressively from intersection to intersection. The system does not need to know where the truck is at all times nor who is driving or who the truck belongs to.
3. *Intended Destination:* A key type of data is the intended destination of the vehicle. The previous two sets of data will provide benefits, however, without knowing the destination the system is restricted to ad hoc responses at an intersection by intersection level rather than being able to see the intended routes of vehicles and finding traffic management solutions that deliver optimal benefits to both freight operators and other road users. This also provides the potential for the traffic management system to provide routeing suggestions to freight vehicles that, for instance, allow greater preferential signalling, depending on time of day traffic conditions. This would also allow real-time diversion of freight vehicles if required to respond to incidents.

Complimentary data sets may include data from empty container parks on vacancy, stevedore timings and availability from Ports, and even data on stress levels on bridges and other infrastructure to inform transport planning.

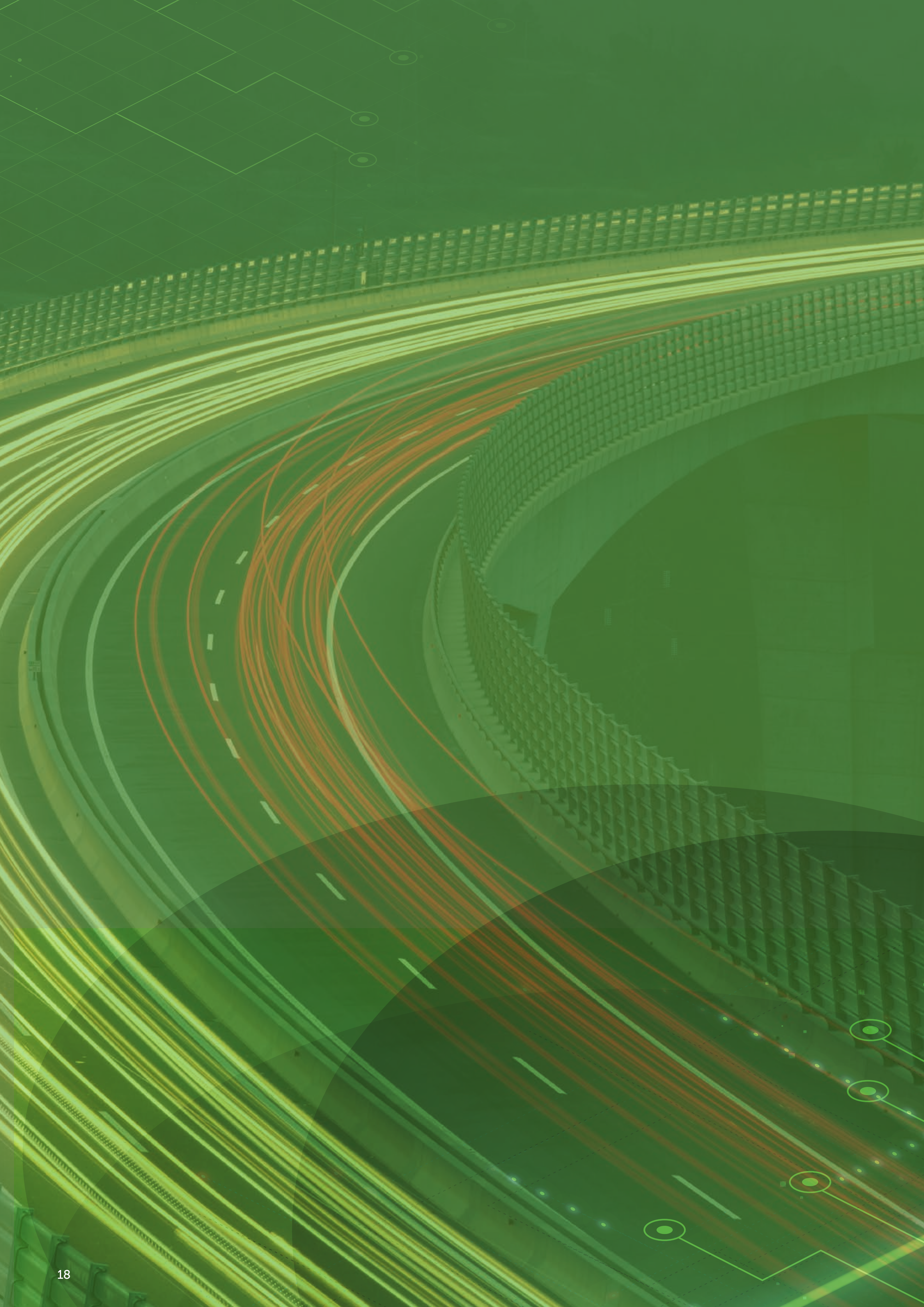
How can data security be ensured?

There are a number of concerns related to the release of vehicle data by the private sector to a government agency, such as:[15]

- Scepticism around the likelihood of seeing direct benefits from the sharing of data with government agencies.
- The risk of hacking or inappropriate access affecting competitive advantage or reputation of specific freight operators or allowing identity fraud.
- The likelihood that controls on the use of data be extended to original equipment manufacturers or service providers that may have access to such data.
- The use of acceleration and breaking data to estimate the weight of vehicles and enforce exceedance of weight restrictions that is currently not monitored electronically.
- The data may be used without permission by law enforcement agencies, such as speeding violations, drive time duration restrictions, and road access violations not otherwise monitored.

Hence it is clear that as part of the FreightSync Roadmap the chosen Freight Observatory needs to consider a similar approach to that used by the TCA to provide a trusted third party broker between the freight operators and the government agencies to ensure appropriate use. This may include the use of 'consent agreements', as with the TCA approach that provides clear guidance as to how data released by freight operators can be accessed by the transport system.

[15] Productivity Commission (2017) 'Data Availability and Use: Overview & Recommendations', Report No. 82, Canberra.



Introducing the 'FreightSync' Roadmap

Taking a multi-stage approach

The FreightSync Roadmap has been designed to be implemented in four stages:

- **Stage 1:** *Understand the Landscape* - focuses on understanding the landscape in which the initiatives of the Roadmap will be implemented. This will include a series of general tasks such as reviewing examples, reports, strategies etc, along with a set of specific tasks.
- **Stage 2:** *Plan the Approach* - then builds on the understanding of the landscape to map out how each track will approach implementation of the Roadmap. This will include configuring and provisioning key structures and frameworks in close collaboration with stakeholders.
- **Stage 3:** *Deliver Early Benefits* - focuses on identifying opportunity's to deliver early benefits to demonstrate the value of the overall process, specifically early benefits.
- **Stage 4:** *Roll-Out Data Exchange* - create an automated system that collects, curates and analyses data for the mutual benefit of freight operators and transport agencies.

Presenting the FreightSync Roadmap

The FreightSync Roadmap is the combination of a set of tasks and objectives for each of the tracks over each of the stages in order to reach a set of preferred destinations, as in Table 4.

Table 4: *The FreightSync Roadmap*

	STAGE 1 Understand the Landscape	STAGE 2 Plan the Approach	STAGE 3 Deliver Early Benefits	STAGE 4 Roll-Out Data Exchange	DESTINATION
Track A: *Freight Operators - Data Collection*					
Tasks	Understand current situation, expectations and benefits	Map out approach to data collection and storage	Create initial cohort of participants with compatible systems	Automate active industry wide participation	Freight operators autonomously synchronised with transport system to reduce trip times
Outcomes	Identify specific risks and rewards from data exchange	Configure and provision data collection	Improved conditions on specific routes at specific times	Feedback from transport system	
Track B: *Freight Observatory - Data Curation*					
Tasks	Understand constraints and expectations	Map out approach to data exchange and privacy	Create value from exchange to support wider data exchange	Automate and expand seamless data exchange processes	Manage seamless data exchange between freight operators and the transport agencies
Outcomes	Identify preferred performance criteria and structures	Configure and provision data exchange platform	Expanded data exchange to include additional participants	Improved access to other heavy and shared vehicles	
Track C: *Transport Agency - Data Analytics*					
Tasks	Understand opportunities and implications	Map out approach to using live data in data analytics	Create mutual value from initial cohort of data	Automate real time data analytics and reporting	Real time synchronisation of freight vehicles with transport agencies for mutual benefit
Outcomes	Identify current processes that can be enhanced	Configure and provision real time data analytics	Improved outcomes to support roll-out of data exchange	Improved modelling, evaluation, and traffic management	

Signposts of the FreightSync Roadmap

The following Tables 5-7 provide initial signposts based on a desktop review and discussion with stakeholders for each track to inform efforts.

Table 5: *Data Collection Signpost for the FreightSync Roadmap (Freight/Telematics Operators)*

STAGE 1 **Understand Landscape**	**TASK: Understand the current state of play and expectations** i. Review examples of transport operators exchanging freight data. ii. Review options for tracking data collection technologies. iii. Investigate potential benefits to participants from data exchange. iv. Identify key existing enablers and disablers to data exchange. v. Consider political and policy positions that affect data exchange. vi. Investigate data sources and associated opportunities and constraints. vii. Summarise transferable findings and outcomes to inform Roadmap.	**OUTCOME** Identification of specific challenges and benefits from data exchange
STAGE 2 **Plan Approach**	**TASK: Map out approach to data collection and storage** i. Identify current data needs, sources, formats and considerations. ii. Review existing data exchange protocols, standards and frameworks. iii. Investigate requirements for data curation and data analytics. iv. Propose a set of standardised data collection protocols and procedures. v. Engage with stakeholders to review and finalise data protocols. vi. Seek industry wide peer review of recommended protocols. vii. Outline considerations for data collection/exchange with operators.	**OUTCOME** Configuration and provision of data collection
STAGE 3 **Deliver Early Benefit**	**TASK: Create initial cohort of participants with compatible systems** i. Collaborate with stakeholders to identify overall goals of trial. ii. Explore the business case for data exchange for mutual benefit. iii. Identify specific data to be exchanged to demonstrate value. iv. Recruit participants in initial trial of specific data exchange. v. Design process to implement initial trial to demonstrate early benefits. vi. Measure tangible benefits from data exchange for operators. vii. Report on overall findings and recommendations for roll-out.	**OUTCOME** Improved conditions on specific routes at specific times
STAGE 4 **Roll-Out Exchange**	**TASK: Automate active industry wide participation** i. Review additional data types to implement real time data exchange. ii. Design work plans for incorporating exchange of new data types. iii. Manage data management security risk and report on status. iv. Ensure mutual benefits are achieved by stakeholders. v. Remove manual intervention stages and replace with automated systems. vi. Inform consideration of data exchange with other vehicle types. vii. Fully integrate real time data from transport management system.	**OUTCOME** Feedback from transport system

Destination: Freight operators autonomously synchronised with transport system to reduce trip times.

Table 6: *Data Curation Signpost for the FreightSync Roadmap (Freight Observatory) (Version 2.0)*

Stage	Task	Outcome
STAGE 1 **Understand Landscape**	**TASK: Understand expectations and constraints** i. Review efforts to curate industry data for compatibility and control. ii. Identify potential stakeholders (data providers, users, and customers). iii. Identify stakeholder's requirements for data, functionality, and assurance. iv. Identify types of service offerings and requirements (storage, etc). v. Identify governance framework for operation of the Observatory. vi. Identify business plan options and revenue models for the Observatory. vii. Identify suitable options for hosting and financing the Observatory.	**OUTCOME** Identification of preferred performance criteria and structures
STAGE 2 **Plan Approach**	**TASK: Map out approach to data exchange and privacy** i. Select form of Observatory and model of operation for program trial. ii. Engage with stakeholders to design Observatory framework. iii. MOUs and consent agreements for data provision and storage. iv. Design functionality of data bridge to agency information systems. v. Design functionality of data bridge to telematics services and operators. vi. Ensure robust approach to data monitoring and security. vii. Development of detailed business case for Observatory.	**OUTCOME** Configuration and provision of data exchange platform
STAGE 3 **Deliver Early Benefit**	**TASK: Create value from exchange to support wider data exchange** i. Confirm requirements of stakeholders and confirm benefits. ii. Select functionality to be tested in trial and assign responsibilities. iii. Design process to implement initial trial to demonstrate early benefits. iv. Implement initial data exchange with stakeholders and fine tune. v. Run the trial as per the business plan with stakeholder engagement. vi. Collate tangible benefits from data exchange for each stakeholder. vii. Report on overall findings and recommendations for roll-out.	**OUTCOME** Expanded data exchange to include additional participants
STAGE 4 **Roll-Out Exchange**	**TASK: Automate and expand seamless data exchange** i. Identity next levels of functionality and associated data requirements. ii. Design work plans for incorporating exchange of new functionality. iii. Design data life-cycle management process and reporting mechanisms. iv. Implement ongoing process to review mutual benefits. v. Remove manual intervention stages and replace with automated systems. vi. Inform consideration of data exchange with other vehicle types. vii. Fully automate data exchange between operators and agency.	**OUTCOME** Improved access to other forms of heavy and shared vehicles

Destination: Manage an autonomous data exchange between freight operators and the transport agencies.

Table 7: *Data Analytics Signpost for the FreightSync Roadmap (Transport Agency)*

STAGE 1 **Understand Landscape**	**TASK: Understand opportunities and implications** i. Identify strategic objectives for use of freight vehicle data. ii. Identify lessons learned from freight and logistics data projects. iii. Identify data uses and benefits for planning and traffic management. iv. Engage with freight industry to explore proposed benefits. v. Identify potential revenue models and monetization opportunities. vi. Identify risk at critical points of data integration with existing systems. vii. Identify use cases and develop criteria for measuring benefits.	**OUTCOME** Identification of current planning processes that can be enhanced
STAGE 2 **Plan Approach**	**TASK: Map out approach to using live data in data analytics** i. Identify capacity of agency technology and upgrade options. ii. Identify needs and processes to format, interpret and transform data. iii. Collaborate with Observatory to establish data exchange protocols. iv. Develop project timelines with key time critical stages and targets. v. Develop data management risk structure with recommendations. vi. Forecast expenditure to deliver data bridge to agency information systems. vii. Engage with approvals process to underpin implementation.	**OUTCOME** Configuration and provision of real time data analytics
STAGE 3 **Deliver Early Benefit**	**TASK: Create mutual value from initial cohort of data** i. Identify use cases likely to deliver early benefits using current options. ii. Explore the business case for data exchange for mutual benefit. iii. Design process to implement initial trial to demonstrate early benefits. iv. Implement initial data bridge to observatory information systems. v. Implement data management risk recommendations. vi. Measure tangible benefits for use cases across transport agency. vii. Report on overall findings and recommendations for roll-out.	**OUTCOME** Improved outcomes to support roll-out of data exchange
STAGE 4 **Roll-Out Exchange**	**TASK: Automate real time data analytics and reporting** i. Select additional use cases to implement real time data exchange. ii. Design work plans for implementation of use cases. iii. Manage data management security risk and report. iv. Ensure mutual benefits are achieved by stakeholders. v. Remove manual intervention stages and replace with automated systems. vi. Inform consideration of data exchange with other vehicle types. vii. Fully integrate real time data with transport planning processes.	**OUTCOME** Improved modelling, evaluation, and traffic management

Destination: Real time synchronisation of freight vehicles with transport agencies for mutual benefit.

Conclusion

The amount of freight carried on Australian roads is projected to grow dramatically in the coming years. If this growth is not properly managed, it may lead to reduced efficiencies, increased costs, safety issues, network congestion, increased noise and air pollution, and higher road construction and maintenance costs. The sector will also likely see a number of disruptions including changes to vehicle types (such as the use of drones, lighter vehicles, and ‘right-sized’ vehicles), new software platforms and their interoperability (such as mobility-as-a-service platforms allowing ride services to integrate passenger and freight services – such as Uber Eats), new database options (such as Blockchain technologies allowing for streamlined supply chain interactions and authentication), and aging transport infrastructure.

Hence it will be important for transport-related agencies to identify ways to harness existing network infrastructure and strategically select new approaches that reduce costs and disruption associated with the projected freight growth. The FreightSync roadmap provides a valuable guide to informing and synergising efforts to harness freight vehicle movement data to deliver benefits to operators and transport agencies. A key element of the Roadmap that stands it in good stead is the inclusion of a ‘Freight Observatory’ that can provide assurance that the data exchanged will be protected and only used for the permitted purpose. In order to demonstrate the benefits of such an approach it is recommended to undertake a trial of data exchange as per the Roadmap, and such a project would be a natural extension to the work undertaken to create the Roadmap.

Moving forward

Building on from this project, a proof-of-concept will be undertaken to demonstrate how data can be securely exchanged between freight operators and transport agencies through a trusted intermediary in a manner that delivers mutual benefit. Based on partner interest, the project will focus on two main areas, namely

a) Securing the exchange of data, and

b) Evaluating possible associated benefits, and will involve a discrete trial of data exchange in collaboration with industry partners. The project will be undertaken in close collaboration with industry partners to ensure robust application of research findings presented in this report, and will explore improved trip duration, congestion management, performance evaluation, and enhanced asset management outcomes.

The objective of the 'Proof-of-Concept' project will be to demonstrate the following:

a) How a data exchange platform between freight vehicles and transport-related government agencies would operate in practice.

b) Identify specific associated risks and benefits for both freight operators and transport agencies.

c) Identify specific recommendations for wider implementation of the approach considering different conditions across the network.

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For further information:
Dr Charlie Hargroves (Project Leader)

Senior Research Fellow, Curtin University
Curtin University Sustainability Policy Institute
charlie.hargroves@curtin.edu.au

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