

ALC AUSTRALIAN
LOGISTICS
COUNCIL
SUPPLY CHAIN EFFICIENCY AND SAFETY

A Single Freight Data Standard for the National Digital Framework

November 2020



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Introduction

It is evident that technology and data will play an increasingly important role in the future operation of Australia's supply chains – allowing Australia to meet its growing freight task more safely and efficiently.

To secure that outcome, there is a significant amount of work to be done to improve both the quality and quantity of data available to policy makers and industry participants regarding the operation of Australia's supply chains.

This Paper sets out the key data elements and standards for achieving this outcome, allowing Australia to more effectively monitor and measure supply chain performance.

It will help promote more efficient deliveries and lower prices for Australian consumers and will also help make certain Australia's export-dependent economy can remain internationally competitive.

The scope of this paper is limited to the movement of freight and heavy vehicles.

Other data elements may be published by other entities that are relevant to other freight modalities. These may be incorporated into this standard as the concept is further developed.

Finally, data aggregators and telematic service providers may also subsequently exchange processes to facilitate the movement of information. This is however out of the scope of this paper.

Further relevant information can be found in the links contained in the [appendix](#).

Background & Policy Setting

In May 2018, ALC held its first Supply Chain Technology Summit (the Technology Summit) to discuss how industry can use technology to improve productivity and safety outcomes.

A clear consensus reached at the Technology Summit was the need for data to promote visibility and interoperability.

Visibility is important as it allows improved predictability, efficiency, productivity, and sustainability, reduced need to keep inventory, the identification of bottlenecks and a reduction in fatigue and errors.

It was further noted that data quality is vitally important. New technologies rely on data feeds. If poor data goes in poor information will come out.

Therefore, every company must take responsibility for the information contained in their systems. This is because end to end supply chains have multiple stakeholders that all rely on each other.

At present, the quality of data able to be passed through the supply chain can be quite poor, especially when participants record freight movements using different data systems that cannot 'talk' to each other, or worse still, where freight movements are recorded on manual paper records or not at all.

Errors can frequently occur as the same information is entered on numerous occasions on different systems. Indeed, it is possible for a single container number to be fed into computer systems up to 30 times as the container moves through the supply chain. This is to satisfy the various requirements of customers, port operators, quarantine, customs operations, and other parties involved in a shipment.

This situation could be greatly improved, and supply chain efficiency greatly enhanced, through the adoption of a single data standard in Australia's freight logistics industry.

ALC has a policy requiring heavy vehicles to be fitted with telematics devices for safety and other purposes since 2010. In 2018, the ALC Board subsequently endorsed a policy committing ALC and its membership to working towards the adoption of global data standards by all participants in the Australian Logistics Industry.

GS1 global data standards offer the ISO/IEC 19987 Electronic Product Code Information Services (**EPCIS**) standard and the associated ISO/IEC 19988 Core Business Vocabulary (CBV) that provides the framework for the interoperable sharing of information about the physical movement and the status of objects including products, materials, shipments etc as they travel the supply chain.

In addition, the ability for industry to physically capture data effectively and automatically about shipments and activities is essential to sharing information about them. Typically, either barcodes or Gen 2 UHF RFID tags should be used to link the physical object to the digital information about the 'what' the 'where' the 'when' and the 'why' dimensions so important in ensuring freight visibility. As technologies evolve, other mechanisms such as sensors or IoT devices could be used to automatically capture data.

The National Telematics Framework, which is administered by Transport Certification Australia (TCA) on behalf of government transport authorities, is aligned with ISO 15638 which establishes the Framework for Collaborative Telematics Applications for Regulated Commercial Freight Vehicles which will enable data to be used for safety, compliance and planning purposes.

The possible combination of the data captured using these standards would appear to have the advantage of bringing together under one regime both heavy vehicle and freight movements, which would:

1. assist in the collection of statistics for purposes such as the ABS Transport Satellite Account, through the presentation of information in a uniform format;
2. provide a uniform data format that can be used for those wishing to enhance the visibility of freight in which they have an interest;
3. present information to road managers in a way that would facilitate decisions relating to access to routes by heavy vehicles;
4. assist compliance with legislation; and
5. facilitate planning by both industry and governments.

How to use this document

This document is designed to be used in a modular fashion, selecting the data elements, and the data layers that are applicable to the relevant application. This document aims to create a single set of 'standards' for Australian industry and government to use, and to support safe and efficient data sharing between commercial entities, government entities, data aggregators and technology providers.

The data elements are separated into data 'layers' (see later further details), which may be used independently or collectively, depending upon the needs of the user. For example, a freight forwarder may be primarily interested in data relating to the goods being transported, while another might seek to combine this with data relating to the vehicle as well. Conversely, many data systems collect information

about the identification, characteristics, and movement of a vehicle without any reference to the freight being carried.

We anticipate there will be different users of this document, including:

- Telematics service providers
- Data aggregators
- Transport operators
- Logistics managers
- Freight customers
- Road managers and public purpose analytics users
- Those developing the National Freight Data Hub.¹

This document aims to provide sufficient information to support interoperability between entities in the freight data chain.

Freight customers may use this document as a reference or requirement for contractors and telematics service providers to comply with in provision of services and data/analytics.

Logistics managers may elect to use this document as a reference to ensure interoperability with other entities such as telematics providers of transport operators, transport operator consignment tracking systems, customer reporting systems etc.

Transport operators may be asked to comply with this document, and either ensure their own commercial systems, or the data services they procure from third parties comply with the standards underpinning this document.

Data aggregators, and **telematics service providers** may be asked to comply with the standards referenced in this document when constructing data schemas, exchange systems and analytics.

Data can be of high public value for **road managers**, **other government agencies** and research purposes. The ability to access, compare, aggregate, and analyse data efficiently for regulatory, planning, policy or transport operational purposes depends on a level of standardisation in data recording, storage, transmission. Government may elect to reference this document in relation to data sharing arrangements for entities in the freight supply chain sharing data for public purposes.

Potential future areas for development

While out of scope for this document at this time, in the future some of the following areas may be considered for inclusion:

- vehicle movements and characteristics beyond movement (harsh braking, fuel use, vehicle combination details etc)
- real time data transfer to support parcel tracking
- driver identity and behaviour (identity, blood alcohol)
- geographic details such as distribution centre characteristics, rest areas etc. and;
- policy setting with business-to-business connections for real-time freight and parcel tracking etc.

¹ <https://www.infrastructure.gov.au/transport/freight/national-freight-data-hub/index.aspx>

Where to go for more information:

- For further policy background: <http://www.austlogistics.com.au/wp-content/uploads/2018/10/A-Common-Data-Set-for-our-Supply-Chain.pdf>
- For further assistance with implementation of GS1 global data standards: email freight.logistics@gs1au.org
- For additional information about the National Telematics Framework please see the TCA.gov.au, or contact us: <https://tca.gov.au/contact/>

Mapping of current data standards

The constant evolution and improving affordability of technology, together with the use of open data standards, offers tremendous scope to improve the efficiency of Australia's supply chains.

The current model of interoperable data standards includes a suite of inter-related standards, formats, and data definitions for a typical "transport hierarchy" as illustrated below.

Ensuring consistent identification at each layer of the transport hierarchy is of critical importance to lay the correct digital foundations upon which relevant additional data can be captured (and potentially shared) across the supply chain. It is the cornerstone of achieving efficient supply chain visibility. Using the same digital language enables the simplification of integration between parties that use different systems; the absence of which either requires multiple entry and translation of the same data element, paving the very real risk of data errors in the process, while also adding unnecessary costs.

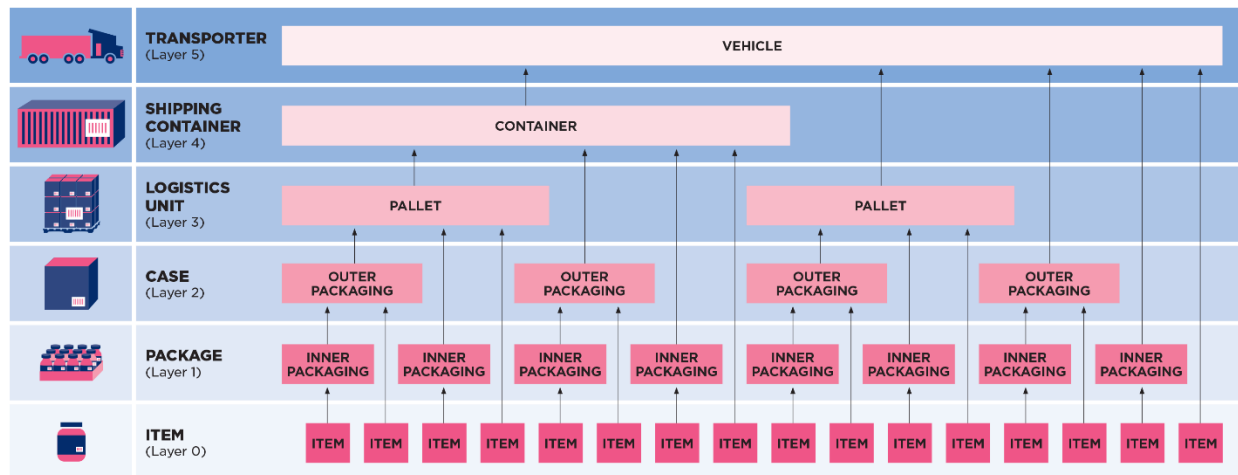


Figure 1: Typical Transport Hierarchy – example of cargo layers

Core data elements

Data elements that are considered common to all supply chains and companies are referred to as being “core” – that is they are used in all like business process types. Core data elements lend themselves to be standardised as there is no value to the process in having different expressions of these data elements. Key transport data requirements relate to:

- Where are transport events taking place – Location Identification
- What is doing the transport – Transport Asset Identification
- What is being transported – Logistic Unit Identification
- Capture and recording of physical transport Events – “What, where, when, why” (e.g. *Container A was at location B at x time/date and it was being “loaded” onto transport asset C*)

The data elements below, relate back to a series of core standards that are referenced in the appendices. These include the:

- **[GS1 General Specifications](#)** – are the foundational GS1 global data standards that define how identification keys, data attributes and barcodes must be used in business applications. The primary audience are technically oriented staff members of companies, solution providers and GS1 Member Organisations. They are used as a foundation for other GS1 standards and services to facilitate data exchange processes and access to local and global digital registries such as:
 - GEPiR (Global Electronic Party Information Registry)
 - GS1 Registry Platform
 - GDSN (Global Data Synchronisation Network)
 - GS1 EDI (Electronic Data Interchange), including the GS1 EANCOM and GS1 XML standards
 - GS1 EPCIS (Electronic Product Code Information Service) & associated GS1 CBV (Core Business Vocabulary)
 - National Location Registry
- **National Telematics Framework (NTF) Data Dictionary** – contains a range of potential data elements that are drawn from the National Telematics Framework Data Dictionary, which relates back to the ISO 15638 Intelligent transport systems — Framework for collaborative telematics applications for regulated commercial freight vehicles (TARV). The NTF seeks to improve telematics data interoperability by defining data elements, levels of assurance and business rules for the use of regulatory telematics, but which can also be applicable to the sharing of data for other purposes.

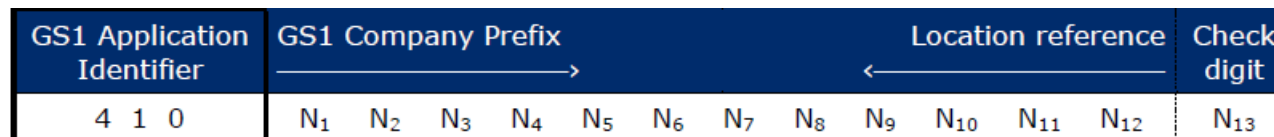
Location data

Location data is fundamental to the physical transport process. The task of efficient pickup and delivery of goods is the cornerstone of the freight sector's operations. The GS1 GLN (Global Location Number) is the key used to identify specific physical locations and to link to additional attributes about that location.

Accurate and timely location master data will be increasingly important to achieving transport task efficiencies and supply chain visibility. Master data can be shared via access to the National Location Registry²

Data Element Name	Description	Standards Reference	Required Data Element Format	Mandatory / Optional	Data origin/source
GS1 Global Location Number (GLN)	Globally unique identification code used to identify physical locations, digital locations, and parties in the supply chain. Appended master data can be accessed via the National Location Registry.	ISO/IEC 6523	Numeric 12 digit plus check digit preceded with Application Identifier ³ (410)	Mandatory if applicable	Allocated by the party who owns or has custody of the location

Figure 2: Format of element string GLN



² National Location Registry is the central repository of trusted source data for locations in Australian supply chains.

³ Application Identifiers (AI) provide the meaning, structure, and function of the GS1 system element string so they can be correctly processed in users' application programs. (see GS1 General Specifications for complete list of AIs)

Layers 0/1/2 – Trade Item data layers

Individual trade items are typically packaged in one or more layers; they can be transported in any one of these layers depending on the requirements of the buyer or the business process being adopted. For all intents and purposes, the transport unit is usually made up of multiple trade items grouped together to create a logistics unit. Most transport companies will track freight at this grouped level depicted in Layer 3 below. For transport companies that do wish to track at the item level, this is made possible by leveraging the item level identification code (GTIN) assigned by the product's brand owner. Trade item data is typically only exchanged between the seller and buyer of the goods; the transport company is often not required to know product details about the trade item except in the case where they are hazardous goods.

Data Element Name	Description	Standards Reference	Required Data Element Format	Mandatory / Optional	Data origin/source
GS1 Global Trade Item Number	Globally unique identification for individual tradeable items and their respective Units of Measure, eg. Inner pack or outer case.	ISO/IEC 15459-1	Numeric 8,12,13 or 14 digit including check digit preceded by Application Identifier ⁴ (01)	Optional for transport processes.	Allocated and applied by the brand owner of the trade item.

Figure 3: Format of the Element String GTINs

GS1 Application Identifier	Global Trade Item Number (GTIN)													
	GS1-8 Prefix or GS1 Company Prefix							Item reference						Check digit
0 1	0	0	0	0	0	0	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈
0 1	0	0	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂
0 1	0	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃
0 1	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇	N ₈	N ₉	N ₁₀	N ₁₁	N ₁₂	N ₁₃	N ₁₄

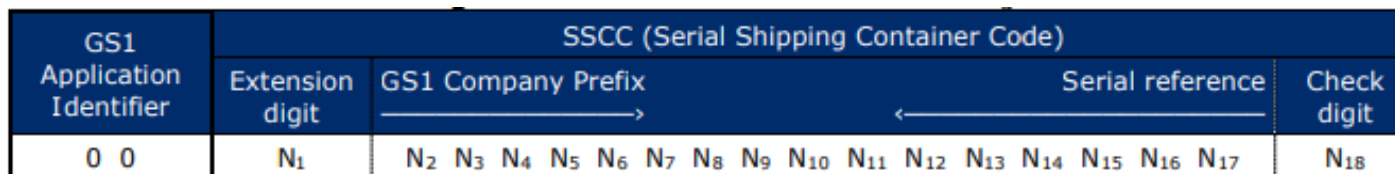
⁴ Application Identifiers (AI) provide the meaning, structure, and function of the GS1 system element string so they can be correctly processed in users' application programs. (see GS1 General Specifications for complete list of AIs)

Layer 3 – Logistics/Transport unit data layer

In executing a transport task, physical and digital identification of the transport unit is the most critical application of the process to enable streamlined exchange of data about the unit. To avoid re-identification at each point in the chain, the globally unique, Serial Shipping Container Code (SSCC) provides a “license plate” if you will for each distinct transport unit, and is the foundation to allow for end to end tracking, visibility, and supply chain connectivity. This identification key is globally certified for both domestic and international identification of freight units the world over. All transport units should be identified with an SSCC encoded in a compliant barcode, printed on a freight label⁵ and affixed to the transport unit so automatic data capture can take place during the physical handling processes at each point in the chain, without need for re-labelling. Data captured electronically can be exchanged with relevant parties. A transport unit may be associated with a consignment which can be identified with a “Global Identification Number for Consignments” (GINC).

Data Element Name	Description	Standards Reference	Required Data Element Format	Mandatory / Optional	Data origin/source
GS1 <i>Serial Shipping Container Code</i> (SSCC)	Serialised identification code used to uniquely identify the transport/logistics unit and should be used as the primary and only end to end tracking identifier. <i>NB: Linked to a transaction reference, the SSCC unpacks the contents of the logistics unit.</i>	ISO/IEC 15459-1	Numeric 18 digit including an extension digit and a check digit preceded by Application Identifier ⁶ (00) see figure 2	Mandatory	Applied by the party creating the logistics unit. The mandatory barcode symbology for SSCC is the GS1-128 with options for additional 2D GS1 DataMatrix or GS1 QR code symbologies

Figure 4: Format of the Element String SSCC

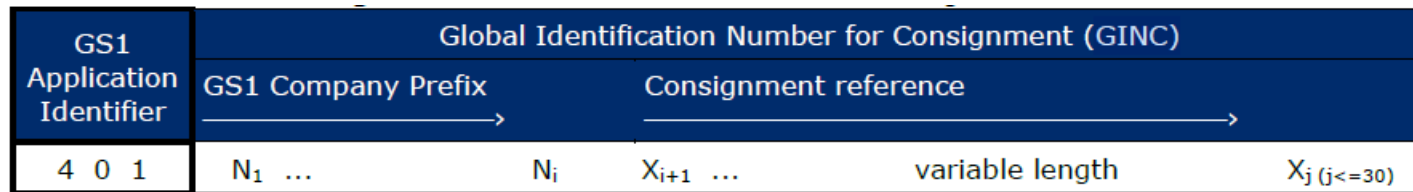


⁵ Freight Labelling guideline can be downloaded from here <https://www.gs1au.org/download/gs1au-guideline-australian-freight-labelling.pdf/file>

⁶ Application Identifiers (AI) provide the meaning, structure, and function of the GS1 system element string so they can be correctly processed in users’ application programs. (see GS1 General Specifications for complete list of AIs)

GS1 Global Identification for Consignment (GINC)	Identifies a logical grouping of goods that have been consigned to a freight forwarder and is intended to be transported	ISO/IEC 15418	AN30 character – variable length with preceding AI (401)	Optional	Allocated by a freight forward or carrier acting as a Freight Forwarder.
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Figure 3: Format of Element String GINC

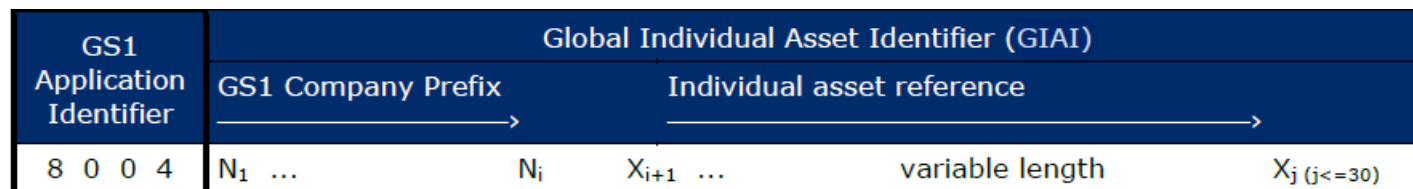


Layer 4 – Container data layer

The container layer can be a shipping container or a ULD in the case of air freight; used for transporting multiple units of freight. The container (or ULD) can be identified with a fixed asset identifier to enable tracking of freight as it is aggregated and disaggregated into and out of these containers.

GS1 Global Individual Asset Identifier (GIAI)	Serialized code used to identify a fixed asset. Eg. Truck or shipping container [could also include BIC code in reference field]	ISO/IEC 15459-4 & 5	AN30 character – variable length with preceding AI (8004)	Optional	Applied by the party who owns the asset
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Figure 5: Format of element string GIAI



Layer 5 – Vehicle data layer

Layer 5 relates to data elements that identifies the freight vehicle and relates to its movement and location at any point in time. It should be noted that the NTF Data Dictionary contains a number of fields that are unique to Australia (such as vehicle combination codes), or that have not yet been codified in an International Standard (such as many of the mass-related fields).

A number of the data elements are optional and relate to preferred format should the data be included in a data set.

Data element	Description	Standards Reference	Required Data Element Format	Mandatory /Optional	Data origin/source
Axle Count	Total number of axles present within an axle group or vehicle (as per context)	ISO 15638	Numeric, 1 to 99, count of axles	Optional	On-Board Mass (OBM) and Telematics device or manual entry for static vehicle configurations
Axle Group Count	Total number of axle groups present within a vehicle	ISO 15638	Numeric, 1 to 99, count of axle groups in vehicle combination	Optional	OBM and Telematics device or manual entry for static vehicle configurations
Axle Group Mass	Mass of an individual axle group	NTF Data Dictionary	Numeric, 1 to 999999, measurement in kilograms	Optional	OBM and Telematics device
Gross Vehicle mass	Total mass of vehicle combination	ISO 15638	Numeric, 1 to 999999, measurement in kilograms	Optional	Telematics device
Latitude	Angular distance on a meridian north or south of the equator	ISO 15638	Location at point in time: Decimal from -90.00000 to +90.00000, Relative to the datum GDA94, Decimals: 5.	Mandatory	Telematics device
Load Status	Indication of whether a vehicle is loaded or not	ISO 15638	Numerated, N = No load; L = Load	Optional	Telematics device or manual entry
Longitude	Angular distance east or west from Greenwich meridian	ISO 15638	Location at point in time: Decimal from -180.00000 to +180.00000, Relative to the datum GDA94, Decimals: 5.	Mandatory	Telematics device
Satellite count	Number of satellites used to establish a measurement made by a GNSS receiver	ISO 15638	Numeric, 0-99, (example of a measurement of GNSS precision)	Optional	Telematics device
Self-Declared Mass	Self-declared gross vehicle mass	NTF Data Dictionary	Numeric, 0.0 to 999.9, measurement in metric tonnes, Decimals: 1	Optional	Manual entry

Vehicle Category Name	Human-readable representation of a predefined Vehicle Category	NTF Data Dictionary	Vehicle Category Name is specific to the National Telematics Framework.	Mandatory	Telematics device or manual entry,
Vehicle Identification Number	Unique code, including a serial number, used by the automotive industry to identify a vehicle	Australian vehicle identification processes	String, 17 digits, (eg: [A-HJ-NPR-Z0-9]{17})	Optional	Recorded manually from Vehicle Identification plate
Vehicle Registration Jurisdiction	Unique identifier for the Jurisdiction where a Vehicle Registration was issued by the relevant authority	Australian vehicle identification processes	Enumerated, Values: VIC; NSW; QLD; SA; WA; NT; TAS; ACT; FIRS	Mandatory	Recorded manually for each vehicle
Vehicle Registration Number	Formal identification of a Vehicle Registration issued by the relevant authority for a Jurisdiction to a distinct vehicle	Australian vehicle identification processes	Alphanumeric string, 6-10 digits in length. Combination of Vehicle Registration Number and Vehicle Registration Jurisdiction is a unique identifier for a registered vehicle	Optional	Telematics IVU

This data may be recorded and stored in a wide variety of formats to meet the needs of specific use cases. An example of a data record using some of these fields is illustrated below.

Vehicle registr'n	Registr'n jurisd'n	Vehicle cat (code)	Vehicle cat	Record Date Time	Position Latitude	Position Longitude	Satellite Count	Hdop Value	Spd	Self-declared mass
ABC123	NSW	17	PBS Quad Dog	2018-08-13 05:31:08	-33.85228	151.21067	4	18.5	50.4	40.1
ABC678	NSW	4	Semi Trailer (Quad Axle Trailer)	2018-08-14 05:31:38	-33.85022	151.21192	3	21.3	49.3	40.1

Conclusion

A data standard like that presented in this document could be potentially used as the basis of any Freight Hub developed under the Freight and Supply Chain Strategy endorsed by the former COAG Transport and Infrastructure Council.

Should there be interest in a form of common database like that presented in this paper, several subsequent issues will require consideration.

They include;

1. identifying the type of entity that could act as a custodian of data provided by industry and stored in a data hub;
2. the standards (including security standards) under which the stored data would be kept;
3. how to manage the various permissions granted by particular industry participants – for example, identifying those who are prepared to allow access to more granular information stored in freight hub because they wish to use the system for freight visibility or regulatory compliance purposes as opposed to those only prepared to permit data to be used (particularly by government) in an aggregated, de-identified form as well as ensuring that data is presented in the same format;
4. ensuring that any data provided is done so on a voluntary basis;
5. Privacy - Identifying who may extract information from a freight hub and why;
6. Whether there are any competition law issues that may arise if there is a desirability to transfer between party's non-proprietary information to encourage efficiency in the supply chain;
7. Identifying how intellectual property rights to data held by parties (or rights conferred on third parties by data owners to exclusively use identified data) can be respected;
8. The instruments governing the operation of any freight hub – these could include;
 - a. A set of interlocking contracts potentially backed by a form of code of conduct; or
 - b. An Act of the Federal Parliament,⁷ and;
9. The development of data exchange processes to facilitate the transfer of information between industry participants and others.

⁷ *Through the use of the trade and commerce, census and statistics and corporations power contained in s.51 of the Constitution*

However, the establishment of a foundation dataset is clearly the first step in developing the National Freight Data Hub forming part of the Freight and Supply Chain Strategy.

Governance

Responsibility for the continued development and publication of this document vests in the Technology Committee of the Australian Logistics Council.

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Appendix

COMPANY INFORMATION

[GS1 Australia in Rail](#)

GS1 is a neutral, not-for-profit organisation that develops and maintains the most widely used global standards for identification and efficient business communication.

We are best known for the barcode, named by the BBC as one of “the 50 things that made the world economy”. GS1 standards and services support lifecycle management through effective maintenance, repair, overhaul (MRO) processes of assets and components across physical and digital value chains in the rail sector.

With local Member Organisations in 114 countries, 1.5 million user companies and 6 billion transactions every day, GS1 standards create a common language that supports systems and processes in 25 sectors across the globe.

For more information visit the [GS1 Australia website](#) or follow us on [LinkedIn](#) and our [YouTube](#) channel.

[Transport Certification Australia \(TCA\)](#)

Transport Certification Australia (TCA) is a national organisation that provides assurance services relating to transport technologies and data to enable improved public purpose outcomes from road transport.

Priority outcome areas enabled by our services include improved road safety, transport efficiency, freight productivity, asset management and sustainability.

Key aspects of TCA include:

- An independent not-for-profit entity, with government oversight
- Administration of the National Telematics Framework, including its rules, specifications, agreements, digital infrastructure and other supporting services
- Assurance services that support but are appropriately separated from regulators, policy makers and enforcement activities, and underpin telematics applications and associated information and data services
- Advice that is based on evidence and a deep subject matter knowledge
- Trusted partner to both government and industry stakeholders, enabling a nationally consistent open market, with services covering all road vehicle types and associated digital infrastructure.

List of Referenced Standards

[GS1 Global Location Number](https://www.gs1.org/standards/id-keys/gln) <https://www.gs1.org/standards/id-keys/gln>

[GS1 Global Trade Item Number](https://www.gs1.org/standards/id-keys/gtin) <https://www.gs1.org/standards/id-keys/gtin>

[GS1 Serial Shipping Container Code](https://www.gs1.org/standards/id-keys/sscc) <https://www.gs1.org/standards/id-keys/sscc>

[GS1 Global Identification Number for Consignment](https://www.gs1.org/standards/id-keys/ginc) <https://www.gs1.org/standards/id-keys/ginc>

[GS1 Global Individual Asset Identifier](https://www.gs1.org/standards/id-keys/global-individual-asset-identifier-giai) <https://www.gs1.org/standards/id-keys/global-individual-asset-identifier-giai>

[GS1 EPCIS and Core Business Vocabulary](https://www.gs1.org/standards/epcis) <https://www.gs1.org/standards/epcis>

[GS1 Standards Page](https://www.gs1.org/standards) <https://www.gs1.org/standards>

Links to National Freight Strategy

<https://www.freightaustralia.gov.au/>

Link to ALC Discussion paper

[A Common Dataset for our Supply Chain](http://www.austlogistics.com.au/wp-content/uploads/2018/10/A-Common-Data-Set-for-our-Supply-Chain.pdf) <http://www.austlogistics.com.au/wp-content/uploads/2018/10/A-Common-Data-Set-for-our-Supply-Chain.pdf>

Links to GS1 Standards and technical documents

[GS1 General Specifications](https://www.gs1.org/standards/barcodes-epcrfid-id-keys/gs1-general-specifications) <https://www.gs1.org/standards/barcodes-epcrfid-id-keys/gs1-general-specifications>

[Freight Labelling Guideline](https://www.gs1au.org/download/gs1au-guideline-australian-freight-labelling.pdf/file) <https://www.gs1au.org/download/gs1au-guideline-australian-freight-labelling.pdf/file>

Links to TCA National Telematics Framework documents

[TCA National Telematics Framework](https://tca.gov.au/national-telematics-framework/) <https://tca.gov.au/national-telematics-framework/>

[Data Dictionary](https://tca.gov.au/national-telematics-framework/) <https://tca.gov.au/national-telematics-framework/>

[List of Vehicle Category Names \(and codes\)](https://tca.gov.au/publications/?filter=functional-technical-specification) <https://tca.gov.au/publications/?filter=functional-technical-specification>

Links to case studies and example 'videos'

[Catch Group Case Study](https://www.youtube.com/watch?v=AL5xmJ5DECc) <https://www.youtube.com/watch?v=AL5xmJ5DECc>