iMOVE 2-020: Key Freight Route Mapping

ARRB Project No.:   Prj-22-00504

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Prepared for: iMove | DITRDCA

December 2022

Final Report

Version Control

Report version no.	Date	Released to client by	Nature of revision
1	December 2022	David Green	Final report

Acknowledgements

On behalf of the Department of Infrastructure, Transport, Regional Development, Communications and the Arts (DITRDCA), ARRB would like to thank all stakeholders who contributed to this project by:

- completing the online survey
- participating in the workshops
- participating in steering committee meetings.

ARRB recognises the invaluable expertise and time people have contributed to this project and would like to extend its thanks to all those who have contributed to the project including representatives from the following organisations:

- Organisations with representatives on the steering committee include:
  - DITRDCA
  - Australian Local Government Association (ALGA)
  - Transport Canberra and City Services Directorate
  - Queensland Department of Transport and Main Roads (TMR)
  - The National Heavy Vehicle Regulator (NHVR)
  - Transport Certification Australia (TCA)
- In addition, other organisations with representatives who provided input via online survey and/or workshops include:
  - Emergency Management Australia/Department of Home Affairs
  - Victorian Department of Transport (Vic DOT)
  - NT Department of Infrastructure Planning and Logistics/NT Government Civil
  - Transport for NSW (TfNSW)
  - Department of Planning, Lands and Heritage Western Australia (DPLH WA)
  - Main Roads WA
  - Local Government Association of Tasmania
  - Municipal Association of Victoria
  - WA Local Government Association
  - Local Government Association of Northern Territory
  - Local Government NSW
  - Commonwealth Scientific and Industrial Research Organisation (CSIRO)
  - Austroads
  - Australian Trucking Association
  - Queensland Trucking Association
  - Australian Livestock and Rural Transporters Association
  - NT Road Transport Association
  - Tasmanian Transport Association
  - Australian Logistics Council
  - Western Roads Federation
  - Australian Rail Track Corporation
  - Australasian Centre for Rail Innovation
  - Diamond Bros

Project Aims and Objectives

The aim of the project was to review the current use of the Key Freight Routes (KFR) map and to conduct a strengths, weaknesses, opportunities, and threats (SWOT) analysis of the KFR map. In doing so, the project sought to:

1. consolidate knowledge of the Australian freight and supply chain's geospatial capability by reviewing mapping systems, current and emerging initiatives, and the input from key stakeholders to identify gaps, overlaps and opportunities in this space
2. identify and review opportunities to improve the KFR map by leveraging existing geospatial capability, increasing engagement through better design, aligning with relevant data standards, and reviewing explicit evidence-based approaches for managing KFR data and access.

The successful completion of these tasks will support the development of recommendations to DITRDCA to inform one of the following two outcomes:

1. The KFR map stays within the Freight and Supply Chain Strategy Implementation Unit of DITRDCA and is enhanced so that it is a better fit under the National Freight and Supply Chain Strategy.
2. It is identified through the project that the KFR map best sits elsewhere and is enhanced so that it is fit-for-purpose in its new home.

The final recommendations were developed following a literature and data review, followed by stakeholder consultations which enabled the strengths, weaknesses, opportunities and threats (SWOT) analysis to be undertaken on the KFR map.

Project Method and Document Structure

This report includes a literature, data review and the outcome of stakeholder consultation, including an online survey and stakeholder workshops. Refer to:

- Appendix A – key findings, including key themes identified during the literature review.
- Appendix B – information on the structure along with key themes identified through the stakeholder consultation.

The structure of the report is as follows:

- Section 1 – an introduction to the KFR map and the guiding principles for defining the KFRs.
- Section 2 – the findings of the SWOT analysis undertaken based on the key findings from the literature and data review and the stakeholder consultation.
- Section 3 – the key recommendations arising from this project.
- Section 4 – the key conclusions of this project.

Executive Summary

Project overview

Land-based freight transport is essential to the efficient movement of goods and the continued economic prosperity of a modern nation. Equally important is the infrastructure that supports these freight movements, which comprise roads and rail lines.

The interactive National Key Freight Routes (KFR) map, hosted by the Department of Infrastructure, Transport, Regional Development, Communications and the Arts (DITRDCA), outlines the KFRs used by land-based freight in Australia.

The aim of this project is to review the current use of the KFR map, and how the map can be optimised to communicate with its key stakeholders more effectively.

To achieve this, a literature and data review was undertaken, followed by stakeholder consultation to enable a strengths, weaknesses, opportunities and threats (SWOT) analysis to be undertaken on the KFR map. This led to the development of recommendations related to the KFR map for consideration by DITRDCA.

SWOT analysis of the current KFR map

The output of the SWOT analysis is summarised in Figure S.1.

Figure S.1   SWOT analysis overview

Strengths	Weaknesses
• Displays national KFRs in one centralised online location. • The KFR map is currently located in the most appropriate location. • Informs decisions relating to the freight network. • Supported by the National Freight Data Hub.	• There is reasonable awareness of the KFR map, but it is rarely used. • The KFR map needs to better address the freight and supply chain strategy. • The designation of KFR needs to be road owner agnostic.
Opportunities	**Threats**
• There is a need to provide contextual information on the KFR map. • The KFR map needs to capture KFRs regardless of road ownership. • Provision of additional information to the KFR map must be targeted.	• The National Service Level Standards framework should inform investment. • The KFR map will need to be kept updated. • Too much change to the KFR map could lead to a loss in value.

Recommendations

Table S.2   Recommendations

No.	Recommendation
1	Inclusion of an 'information page' which provides the context on the purpose of the KFR map and the role of the KFR visualisation in comparison to other freight initiatives including the National Freight Data Hub, National Heavy Vehicle Regulator (NHVR) portal, Commonwealth Scientific and Industrial Research Organisation (CSIRO), and state-based tools.
2	Specific recommendations, relating to enhancing the KFR map to ensure the map remains fit-for-purpose as a policy tool under the National Freight and Supply Chain Strategy include: <table><tr><td>Level 1 priority enhancements</td><td>Identify areas that are at high risk to natural disasters (e.g. bushfires, floods) as a layer on the KFR map. This will help to understand the availability and extent of alternative freight routes to the KFRs to enable better disaster management in the future.</td></tr><tr><td></td><td>Label alternative routes for the KFR segments at high risk to natural disasters.</td></tr><tr><td></td><td>Label the factors that contributed to the route being designated as a KFR.</td></tr><tr><td></td><td>Provide information on rest area serviceability.</td></tr><tr><td></td><td>Label the areas of the KFR network that are gazetted B-double and PBS routes.</td></tr><tr><td></td><td>Label the KFR network as sealed or unsealed.</td></tr><tr><td></td><td>Label the location of railway level crossings and their type (e.g. active level crossing controlled by boom gates and flashing lights, active level crossing controlled by flashing lights only, or non-active level crossing indicated by a static warning sign).</td></tr><tr><td></td><td>Ensure the information on the location of major intermodal facilities is current, including major intermodal facilities not currently identified on the KFR map.</td></tr><tr><td>Level 2 priority enhancements</td><td>Overlay mobile phone network coverage on the KFR map.</td></tr><tr><td></td><td>Label the rail network according to rail gauge.</td></tr><tr><td>Level 3 priority enhancements</td><td>Provide heavy vehicle (HV) traffic count information at key points on the KFR network.</td></tr><tr><td></td><td>Label the rail network according to its ability to accommodate double-stacked trains.</td></tr><tr><td></td><td>Show the current, yet-to-be-completed, and potential future KFR network.</td></tr><tr><td></td><td>Show commodity producing areas of national significance.</td></tr><tr><td></td><td>Include LGA boundaries.</td></tr></table>
3	The guiding principles for determining KFR routes of national importance are maintained. However, consideration needs to be given to the inclusion in the KFR network of local government roads that are gazetted B-double and PBS routes and provide first and last kilometre access to destinations of national significance.
4	Consideration needs to be given to adding the KFR map as a layer to other freight initiative maps. The road component of the KFR map could be a layer on the National Service Level Standards (NSLS) framework, once developed. This will enable the performance metrics being developed through the NSLS, and which are applicable to the KFR network, to be displayed on the KFR network as a filtered option.
5	The KFR map needs to refer to the NSLS project for the display of performance metrics. This is because the NSLS framework will be seen by many as the main tool to advocate for funding with respect to upgrading the KFRs.
6	The KFR map needs to be under policy authority of the Freight and Supply Chain Strategy team of DITRDCA and be maintained by a team with relevant data expertise and responsibility for Freight and Supply Chain Strategy data projects.
7	The KFR map needs to be updated and enhanced with this information. Once the information is included, the KFR map needs to continue to be maintained and kept up to date, in accordance with the following guidelines. 1. Jurisdictions need to continue to review their freight networks. If they wish to re-define a route as a KFR, or re-define a route as no longer a KFR, then this must be reflected on the KFR map as soon as possible after the determination has been made. Jurisdictions will be required to notify the Freight and Supply Chain Strategy team of DITRDCA (or any other body determined to be responsible for maintaining the KFR map) to ensure any updates can be made. 2. Updates to the KFRs (excluding HV traffic counts) need to occur every 6 to 12 months. 3. Any updates of HV traffic count information obtained through jurisdictional estimates and data, need to occur every five years.

Contents

Tables

1.   Introduction

Land-based freight transport is essential to the efficient movement of goods and the continued economic prosperity of a modern nation. Equally important is the infrastructure that supports these freight movements, which comprise roads and rail lines.

The interactive National Key Freight Routes (KFR) map hosted by the Department of Infrastructure, Transport, Regional Development, Communications and the Arts (DITRDCA) (DITRDCA n.d.), outlines the KFRs used by land-based freight in Australia.

The map provides a geospatial picture of the road and rail routes of significant economic importance for Australia. It provides a picture of the key Australian road and rail networks used by the logistics and freight industry for the transport of resource and agricultural commodities. The map shows how the network connects Australia's resources and commodity-generating areas with nationally significant freight, including ports, airports, and intermodal terminals (Yue & Wiley 2021). It serves as a strategic visual tool to support planning, operational and investment decisions relating to the Australian freight network.

The map replaced the 40 individual jurisdictional PDF maps used prior to 2015. It represents the culmination of agreement between government and industry on the need to apply a national focus to deliver a more streamlined transport and logistics system, capable of efficiently moving freight throughout Australia.

The guiding principles for the identification of KFRs are that road and rail routes (Transport and Infrastructure Council n.d.):

- connect existing and potential nationally significant locations for freight such as:
  - intermodal freight terminals
  - industrial, mining and agricultural precincts
  - significant freight destinations in regional centres
  - interstate freight
- carry a combination of, or either:
  - high volumes of freight
  - high-value commodities
  - a high frequency of heavy vehicles
  - specific commodities of high economic significance for the region.

2. SWOT Analysis

2.1 Strengths

2.1.1 Displays National KFRs in One Centralised Online Location

The key strength of the KFR map is that it brings together the individual jurisdictional KFRs into one central location and displays this via an online interactive map.

The actual KFRs were determined by jurisdictions based on guiding principles related to connectivity and function.

It was confirmed through the consultation that the current principles for defining the KFRs are adequate. However, knowing what commodity/industry the KFR serves would help to understand why a route is determined to be a KFR (see opportunities in Section 2.3).

2.1.2 The KFR Map is Currently Located in the Most Appropriate Location

The online survey found that approximately 85% of respondents felt that the KFR map needs to continue to be owned and maintained by DITRDCA, with policy responsibility remaining with the Freight and Supply Chain Strategy team of DITRDCA. This was well supported during the workshops. Key points supporting this view included:

- the Supply Chain Strategy provides a mechanism to resource any potential updates to the KFR
- the National Freight Data Hub, managed by DITRDCA provides key data resources of relevance to the KFR map
- the KFR map includes rail networks; therefore, the appropriate home is the DITRDCA.

The technical administration and maintenance should be done by the team with relevant data expertise and responsibility for Freight and Supply Chain Strategy data projects.

2.1.3 Informs Decisions Relating to the Freight Network

The National KFR map provides a mechanism to inform decision-making relating to freight infrastructure policy, regulation, planning and operational issues.

Commentary at the stakeholder workshops indicated that the primary purpose of the KFR map is to assist in investment decisions, but not the sole source of information with respect to this. Jurisdictions will still need, and continue to use, other tools when making investment decisions.

While the KFR map can assist in investment decisions, it is acknowledged that its role is not to provide a mechanism for payment of Commonwealth transport infrastructure funding, this being the role of the National Land Transport Network (NLTN).

The stakeholders felt that, to better assist governments to make informed investment decisions, the KFR map needs to provide additional information (see opportunities in Section 2.3).

2.1.4 Supported by the National Freight Data Hub

The National Freight Data Hub, which is managed by DITRDCA, provides key data resources of interest to the KFR map and therefore is well placed to support the KFR map and policy decisions with respect to freight-related data.

Of particular interest is information on the location of heavy vehicle rest areas as collated by the National Freight Data Hub. This is discussed further as part of recommendation 2 (see Section 3) which relates to enhancing the KFR map through inclusion of rest area serviceability information based on information contained within the National Freight Data Hub.

2.2 Weaknesses

2.2.1 Reasonable Awareness but Rarely Used

The online survey found that approximately 60% of respondents were aware of the KFR map. However, both the online survey and workshops confirmed that the KFR map is rarely used because it does not provide information that is useful to either road managers or industry:

- Road managers tend to use jurisdictional maps. Their investment decisions are based primarily on local considerations.
- The industry predominantly uses jurisdictional maps and the National Heavy Vehicle Regulator (NHVR) route planner. Industry is focused on access and route choice that minimises the cost of the transport task.

2.2.2 The KFR Map Needs to Better Support the Freight and Supply Chain Strategy

The KFR map could better address the National Freight and Supply Chain Strategy by improving the utility of the KFR map so that it can better assist with the planning associated with delivering a more fit-for-purpose and resilient national freight network. In doing so, help support achieving the six goals of the National Freight and Supply Chain Strategy (Transport and Infrastructure Council 2019a) which are

1. improved efficiency and international competitiveness
2. safe, secure and sustainable operations
3. a fit-for-purpose regulatory environment
4. innovative solutions to meet freight demand
5. a skilled and adaptable workforce
6. an informed understanding and acceptance of freight operations.

This could be achieved by providing additional data and information to the KFR map (see opportunities in Section 2.3).

2.2.3 The Designation of KFR Needs to be Road Owner Agnostic

The KFRs are limited to state-owned routes, with no local government roads designated as KFRs (see opportunities in Section 2.3).

2.3 Opportunities

2.3.1 Contextual Information

There is an opportunity for the KFR map to include an 'information page' which provides an overview of what the KFR is and its role. It needs to refer to other freight initiatives and their role, so users understand the difference. This shall include outlining the purpose of the NLTN as a layer of the National KFR map and defining how it is different to the KFR network.

2.3.2 Capture KFRs Regardless of Road Ownership

There is an opportunity for the KFR map to capture local government-owned roads that may meet the guiding principles for defining a KFR. This would include local government roads that are gazetted B-double and PBS routes and provide first and last kilometre access to destinations of national significance.

2.3.3 Target the Provision of Additional Information to the KFR Map

There is an opportunity to provide additional information to the KFR map that will enhance its serviceability and utility in line with the National Freight and Supply Chain strategy.

Both the online survey and stakeholder workshops found that the KFR map could be made more useful and of higher value to stakeholders if additional information was provided.

While 76% of respondents to the online survey expressed a belief that the KFR map is a good place for freight route information to be displayed, the stakeholder consultation workshops revealed that the ability to access information is more important than where it is displayed. When explored through the workshops it was observed that:

- Jurisdictions will largely continue to refer to their own maps as that is where their interests lie.
- Industry will largely continue to utilise the NHVR route planner and jurisdictional maps (until incorporated into the NHVR portal and next generation route planner). This will contain the HV access information that is the focus of their advocacy programs (i.e. HV access).

Therefore, whether information is displayed on the KFR map or other initiatives did not appear to be a major concern to stakeholders. The focus is to not make the KFR map too overwhelming and difficult to use, navigate and maintain but rather to keep it simple but include additional targeted information to help inform decision making and enhance its usefulness and relevancy to stakeholders. Additional information shall leverage off existing datasets which align with the DITRDCA's data strategy to enhance its GIS capability. However, the additional information needs to be targeted and the KFR map seen as a visualisation tool that, for example:

- graphically displays (a map) the KFR network rather than listing them in a table
- provides targeted information for decision making associated with freight infrastructure of national significance
- refers to, rather than duplicating potentially contradictory information contained in other freight initiatives
- is kept simple so that it:
  - limits the resources required to maintain the KFR map
  - minimises the risk of the KFR map containing information that conflicts with information contained in other freight initiatives
  - is easier to use and refer to.

The following key aspects were identified during the stakeholder consultation workshops as opportunities to enhance the KFR map.

Gazetted road network: to better understand the extent of the KFR network that has gazetted access

A disclaimer needs to be included stating that the information should not be viewed as the primary source of access information but, rather, is provided for planning and advocacy purposes. The disclaimer needs to also refer users of the KFR map to the NHVR portal and next generation route planner and jurisdictional maps for up-to-date access information for a particular link/route. The NHVR portal and next generation route planner will contain access information in a nationally-consistent manner and will become the single source of truth for gazetted networks.

Road surface status (sealed/unsealed)

The KFR map needs to show the surface status (i.e. sealed or unsealed) of the links within the KFR network. There was a common view amongst the stakeholders that all KFRs should be sealed as a default. Therefore, showing the status would ideally become redundant.

Rest area serviceability

Providing information on rest areas on the KFR map, would be seen as a significant win by industry, as this would help industry advocate for them.

Railway level crossing locations and type

The KFR map needs to show the location of railway level crossings and their type including whether the railway level crossing is an:

- active level crossing controlled by boom gates and flashing lights
- active level crossing controlled by flashing lights only
- non-active level crossing indicated by a static warning sign.

Mobile phone network coverage

Information on mobile phone network coverage is an advocacy priority for industry associations. Currently industry cross-references between the telecommunications provider's mobile phone network coverage maps, and the freight network.

Mobile phone network coverage is also an area that the Australian Government has invested in on behalf of the industry as part of programs such as the Federal Government *Mobile Black Spot Program* (DITRDCA 2022a).

Overlaying mobile phone network coverage on the KFR map would identify black spot locations across the network. This is becoming increasingly important given that data transfer online is required for freight operations – associated with work diaries, identification, manifest and documents required by the Police, etc. Telecommunications providers will need to be asked for coverage data. Given Telstra is the major national telecommunications provider across urban and rural areas, the focus needs to be on providing coverage data of the Telstra mobile phone network.

HV volume information

It would be beneficial to add HV traffic count information at key points on the routes to the KFR map. This could involve utilising jurisdictional data/estimates and updating every five years. This would help with various advocacy initiatives as it would give an indication of the number of HVs impacted by such events as road closures (e.g. the number of HVs stopped at state and territory borders as a result of a border closure).

Indication of commodities of national interest that the KFR caters for

Provision of information on what commodities of national interest the KFR caters for will help in obtaining an understanding of why a route was designated as part of the KFR network. This would assist investment planning as it will provide context around the value of the KFR from a national perspective, regardless of volume.

For example, a KFR could have high value but low volume or infrequent use. The investment needed to maintain this KFR may be different to that of a route with high volume and high frequency of use. Equally, if the route is a lifeline for the community, then additional weight may be given to maintenance.

Understanding why the route was designated as part of the KFR network will require jurisdictional advice on the commodities/industries which utilise the route for transport as part of their supply chains.

Jurisdictions need to outline what are the nationally significant commodities transported on the route and/or which nationally significant industries does the route serve.

The ability to filter on the KFR map according to key commodity types of national significance would be of interest, as it would assist in gaining a better understanding of the different parts of the KFR network.

Rail gauge

Information on the rail gauge of the rail network that makes up the KFR network would be beneficial and help gain a better appreciation of how extensive the issue is with respect to differences in rail gauge across Australia.

Ability to accommodate double-stacked trains

Information on the ability of the rail links to accommodate double-stacked trains was identified in the industry workshop as being a useful feature to include in the KFR map.

Current, yet-to-be-completed, and potential future KFR networks

The KFR map needs to not only display the current KFR network but also any yet-to-be-completed components of the network that will need to meet the principles for being designated as a KFR later, for example, Inland Rail.

In addition to the yet-to-be-completed KFR networks, the KFR map could help with future planning by showing key identified potential freight generating areas of national significance. It could also provide an indication of the potential future KFR networks that are being considered to accommodate these areas.

Intermodal facilities

There is an opportunity for the KFR map to be used to gain a better understanding of intermodal relationships (i.e. where freight hubs interconnect). This was identified in both the industry and agencies workshops.

The ability to identify intermodal facilities and recognise the interaction between the road and rail networks within Australia (the two key land-based freight networks) is a key feature of the KFR map. This differentiates it from other freight mapping initiatives which tend to focus on one type of infrastructure, that being either the road or rail infrastructure network, and not both on the one map.

Areas/regions at high risk to natural disasters

Including areas that are at high risk to natural disasters (e.g. bushfires, floods) as a layer on to the KFR map could be beneficial in understanding where the KFR network is susceptible to closure resulting from natural

disasters. This would assist in gaining a better understanding of what the alternative routes are. Non KFRs could be identified as an additional layer to help determine if they are adequate in the event of a disaster.

The KFR map could also refer to the outcomes of the BITRE Road and Rail Resilience Review (DITRDCA 2022b), in addition to the National Service Level Standards (NSLS) framework which is hoping to obtain metrics on road closure statistics.

Local government areas

Local Government plays a key role in freight supply chains as they are often the road manager dealing with first and last kilometre access and providing the feeder roads to the KFRs. The KFR map has potential value in helping understand where KFRs pass through Local Government Areas (LGAs). Having the ability to understand which local government roads have KFRs passing through their city/shire may help inform decision making, funding allocation and advocacy.

Key commodity producing areas/regions

The KFR map could be enhanced if commodity producing areas of national significance are included. This will inform how the KFR networks serves these regions and help identify deficiencies and plan for upgrades to the KFR network.

Consideration needs to be given to displaying both current and future areas which are producing commodities of national significance.

The TraNSIT model could be used as the basis for this information. The TraNSIT model maps the supply chains between production and domestic and export markets for 98% of all agricultural transport within Australia. TraNSIT currently accommodates over 150 commodities representing 25,000,000 vehicle trips and 200,000 rails trips per annum. Further commodities and transport modes are also being added (Commonwealth Scientific and Industrial Research Organisation (CSIRO) 2022a).

2.4   Threats

2.4.1 The National Service Level Standards Framework Should Inform Investment

The NSLS framework project will categorise the road network according to a wide variety of metrics including productivity, reliability, facilities, amenities, and crash rating, etc. The framework will guide Australian Government investment decisions and is therefore relevant to freight operators and road managers.

Under the NSLS framework, roads will be categorised by function. This will allow for comparison between current service performance and a benchmark standard (the benchmark standard to be based on the road function). Categorising the road network by road function will enable the ability to highlight the roads of critical importance for freight.

All governments will use the NSLS information, not just the Commonwealth, to inform prioritisation of road investment. Road users will have access to the same (public) information and will be able to point to roads where the current performance is deficient compared to the standard.

At the industry workshop it was suggested that the NSLS framework should be guiding investment decisions with respect to the road network, acknowledging that currently the NSLS does not include rail.

The road freight industry is looking to the NSLS framework as the main tool with which to advocate for funding with respect to upgrading the KFRs.

The view from the stakeholder workshops was that there is a concern with overlap between the KFR map and the NSLS framework. Generally, it was thought that the NSLS framework would ultimately replace the KFR.

Further, stakeholders felt that the KFR map must not display contradictory or misaligned information to that to be included in the NSLS framework.

The KFR needs to refer to the NSLS project for the display of performance metrics, with the KFR map kept simple and displaying just additional targeted information to increase its value amongst stakeholders.

Once the NSLS framework is developed the KFR map could become a layer within the NSLS framework as a way of displaying information applicable to only the KFR network as opposed to the broader network. This could be considered as a future opportunity.

2.4.2 The KFR Map Will Need to be Kept Updated

The KFR map needs to be kept up to date to ensure its continuing relevancy. Defining the KFRs needs to occur as soon as a route is determined to be a KFR and part of the KFR network.

For information (excluding HV traffic count) on the KFRs, an update interval of 6 to 12 months is considered reasonable. This includes the names of the road and rail managers who own the assets that make up the KFR network.

In terms of HV traffic count information obtained through jurisdictional estimates and data, an update every five years is considered reasonable.

2.4.3 Too Much Change Leading to Loss of Value

In the process of changing the KFR map there is potential to overload the National KFR map with too many layers of information, with the detail and value potentially being lost.

Undertaking a change to the National KFR map may have impacts on legacy systems and there is potential to undertake too much of a change, resulting in the map losing its value. This can be mitigated by being selective in what changes are made to the KFR map and prioritising those enhancements. This project achieves this by recommending the provision of additional targeted information (see the opportunity outlined in Section 2.3.3 and recommendations in Section 3).

3. Recommendations

Recommendation 1: Contextual information

Based on a synthesis of the findings from the online survey and workshops it is recommended that the KFR map include an 'information page' which provides context on the KFR map by addressing the following:

- provide an overview of what the KFR visualisation is and its role
- outline the principles for defining the KFR and ensure that the KFRs are determined by the jurisdictions based on these principles
- include the date when the map, and the information contained on the map, was last updated
- outline the key stakeholder groups that may refer to the KFR map and provide a description of the KFR map's role relative to, and with reference to, the other freight initiatives that will help the stakeholder groups achieve their role. This could be presented in tabular form such as outlined in Table 3.1.

Table 3.1:   KFR map role for the stakeholder and other freight initiatives

Stakeholder	Stakeholder role	KFR map role for the stakeholder	Other freight initiatives that need to be referred to
Commonwealth	Overarching interest in national freight and supply chains, including the key road and rail routes connecting Australia's nationally significant places for freight, including ports, airports and intermodal terminals and their role and performance in supporting the national economy and well-being.	The KFR map provides a complete picture of the KFR network comprising both road and rail across Australia. The KFR map provides a detailed picture of the road and rail routes connecting Australia's nationally significant places for freight, including ports, airports and intermodal terminals. The KFR map provides a policy tool to inform strategic planning, and operational and investment decisions across the Australian freight network.	While the KFR map provides a picture of the KFR network and places of national significance for freight, there are other initiatives which provide further details relating to freight performance and data. These include: • The National Freight Data Hub needs to be referred to for freight-related data and visualisations. • The TraNSIT web portal needs to be referred to for information on freight movements based on commodities as determined through modelling. • The future NSLS framework needs to be referred to for performance metrics on the road network, including the KFR network (which could be referenced as a layer). The performance metrics within the NSLS are wide ranging and determined based on their importance to road users, including freight. • The NLTN needs to be referred to, given its role in providing a mechanism for commonwealth funding of roads under the National Land Transport Act.
NHVR	Establish and maintain the NHVR portal and next-generation route planner. This will enable operators to plot routes, calculate time and distance, and apply for heavy vehicle access from road managers across all jurisdictions in a nationally consistent manner.	The KFR map's role for the NHVR is that it can be a reference point to understand the routes determined as KFRs across Australia.	The KFR map needs to refer to the NHVR portal and next generation route planner which is being enhanced through the national spatial program. It will deliver a nationally consistent route planning platform (NHVR 2022).

Stakeholder	Stakeholder role	KFR map role for the stakeholder	Other freight initiatives that need to be referred to
State/territory road transport agencies/departments	Management of the freight network including the segments of the freight network designated as KFRs.	The KFR map brings together, in one national online map, the KFRs as designated by each state/territory road transport agencies/departments. This enables each jurisdiction to see how the KFR network within their jurisdiction fits into the national context. This may assist state/territory agencies/departments to advocate for certain policy direction at the national level with respect to networks within their jurisdiction.	State/territory road transport agencies/departments need to refer to the jurisdictional freight network maps (road and rail) within their jurisdiction and neighbouring jurisdictions (if required). This is to gain a better understanding of the broader and complete freight network (not just those freight networks designated as KFRs, but also lower categorised freight networks (e.g. principal freight network)) within their own and neighbouring jurisdictions.
Local government	Management of local roads and the local government area (LGA) including managing community concerns relating to amenity.	Interested in knowing what KFRs traverse their LGA and where and how they interact with the local government road network. Also interested in knowing if any local government roads that they manage are part of the KFR. The KFR map provides local government with an opportunity to advocate to improve networks on key routes.	Local government need to refer to their own as well as the state/territory agencies/department freight network maps (road and rail), for the jurisdiction which the local government is located.
Freight industry and industry associations	Knowledge on freight access.	The KFR map can therefore be used by the freight industry and industry associations to advocate for improved freight networks and services across Australia.	Freight industry and industry associations need to refer to other freight initiatives for detailed and current information relating to freight access and to help with advocating for improved freight networks. Other identified freight initiatives that need to be referred to include: • Jurisdictional freight maps with respect to current information on HV access rights. • The future NSLS framework need to be referred to for performance metrics on the road network, including the KFR network.

Recommendation 2: Update and enhance the KFR map through inclusion of additional information on the KFR map

Based primarily from findings from the workshops, but also informed through the online survey and literature review, it is recommended that the KFR map be updated and enhanced, through inclusion of additional information on the KFR map, so that it better fits under the National Freight and Supply Chain Strategy and helps to inform improved decision making and investment decisions.

Updating the KFR map will require asking jurisdictions to check the validity of their KFR designations.

Enhancing the map will require the provision of additional information. Outlined below are a series of identified enhancements that have been derived through the SWOT analysis. These are all considered as priority enhancements but have been grouped into three levels, with Level 1 considered the highest priority enhancements and Level 3 having less priority, relatively, although still considered a priority. The Level 1 to Level 3 enhancements recommended for the KFR map are outlined in the following tables:

• Level 1 priority enhancements: Table 3.2
• Level 2 priority enhancements: Table 3.3
• Level 3 priority enhancements: Table 3.4

The enhancements focus on achieving a balance between the need to enhance the KFR map, but to not overly complicate it with data that is difficult to maintain and interpret. In that sense the identified amendments are expected to enhance the value of the KFR map rather than reduce the value of it.

Table 3.2:   Level 1 priority enhancements

Enhancement	Description
Areas/regions at high risk to natural disasters.	To understand the resiliency of the network it is important to identify areas that are at high risk to natural disasters (e.g. bushfires, floods) as a layer on the KFR map. This will help identify the extent of the alternative routes to the designated KFRs in areas which are at high risk to natural disasters, and road closures, in response to natural disasters.
Alternative routes to the KFR segments at high risk to natural disasters.	Enable the identification of at least one alternative freight route for the segments of the KFR that are at high risk of closure due to natural disasters and show them as a layer on the KFR map. This will help identify areas where the use of the alternative routes will result in significant costs to industry due to the additional length and time incurred. It is acknowledged that a natural disaster could potentially close both the KFR and alternative route/s. For this reason, identification of the alternative route/s would require consideration of the designation and viability of the alternative route/s.
Indication of commodities of national interest that the KFR caters for.	Provision of information on what commodities of national interest the KFR caters for will help in obtaining an understanding of why a route was designated as part of the KFR network. This would help in investment planning as it will provide context around the value of the KFR from a national perspective, regardless of volume. This will require jurisdictional advice on what commodities of national interest the KFR caters for. This information needs to be made available on the KFR map for each KFR and key segment and made visible by the user of KFR map clicking on the KFR of interest and obtaining access to the information. Currently the information on each KFR, which is available via clicking on the KFR of interest, is generally limited to type (e.g. road), name (e.g. road name) and manager (e.g. road agency). If the KFR was serving many commodities of national significance such as the Hume Highway, it could be labelled that many commodities of national significance utilise the KFR. However, if the KFR was only used to transport a few major commodities of national significance these could be identified so that it is clear.
Rest area serviceability:	Rest area serviceability is an area of high interest and importance to industry. Therefore, the provision of information on rest area serviceability on the KFR map would be welcomed. Ideally the rest areas would be identified and classified in accordance with the Austroads *Guidelines for the Provision of Heavy Vehicle Rest Area Facilities* (Green et al. 2019). However this may require significant resources to obtain the data to classify the rest areas and would be a significant project in itself. As a starting point, it is recommended that the KFR map utilise the rest area information contained on the National Freight Data Hub which includes rest area location data and information on the facilities at the rest area (toilets, lighting, power, water, table, bin, shade/shelter, etc.) in addition to data on the utilisation of the rest area (i.e. the number of recorded HV stops and median duration of those stops).
Gazetted road network.	Labelling the KFR network that are gazetted B-double and PBS routes. This will enable the identification of the components of the KFR network which are gazetted and the components of the KFR network which are not. This must include a disclaimer outlining that the information must not be viewed as the primary source of access information.
Road surface status.	Labelling the KFR network as being sealed or unsealed. This will enable the identification of the proportion of the KFR network which is unsealed. It may be viewed by some that the entire KFR network should be sealed.
Railway level crossing.	Labelling the location of railway level crossings and their type (e.g. active level crossing controlled by boom gates and flashing lights; active level crossing controlled by flashing lights only; or non-active level crossing indicated by a static warning sign). It may be viewed by some that the KFR network should not include any non-active level crossings.
Intermodal facilities.	Updating and providing information on the location of additional major intermodal facilities will help understand how effectively the KFR network serves them. Intermodal facilities are currently a layer on the KFR map; however, it was felt by several stakeholders that some key intermodal facilities were missing.

Table 3.3:   Level 2 priority enhancements

Enhancement	Description
Mobile phone coverage.	Addressing mobile black spots is already an interest area of government and information on mobile phone network coverage is an advocacy priority for industry associations. Therefore, overlaying mobile phone network coverage on the KFR map would be welcomed as it will help identify black spot issues across the network.
Rail gauge.	Labelling the rail network according to rail gauge will help to identify how extensive the issue is with respect to inconsistent rail gauge across the KFRs in Australia.

Table 3.4:   Level 3 priority enhancements

Enhancement	Description
HV volume information.	The provision of HV traffic count information at key points on the KFR network would help with various advocacy initiatives as it would give an indication of the number of HVs impacted by such events as road closures.
	It is recommended that jurisdictional data/estimates on HV traffic count information be utilised and displayed on the KFR map. This needs to be updated every five years.
Ability to accommodate double-stacked trains.	Labelling the rail network according to its ability to accommodate double-stacked trains will help to understand how extensive the issue is with respect to double-stacked train access across the KFRs in Australia.
Current and yet-to-be-completed and potential future KFR network.	Showing the current and yet-to-be-completed and potential future planned KFR network (e.g. Inland Rail) in addition to the current and completed KFR network will help with future planning and visions of the KFR network. This is provided that the yet to constructed route is planned to be a KFRs and will meet the defining principles once constructed.
Key commodity producing areas/regions.	Showing commodity producing areas of national significance on the KFR map will help understand how the KFR networks serves these regions and will help identify deficiencies and assist in planning for upgrades to the KFR network.
Local government areas.	LGA boundaries need to be shown on the KFR map. This will help identify which members of local government have KFRs passing through their area and may help with informing decision making, funding allocation and advocacy.

Recommendation 3: KFR determination

It was confirmed through the workshops that stakeholders felt that the guiding principles for determining what routes are designated as KFRs of national importance are considered appropriate. For this reason, it is recommended that these not be changed.

It is recommended that state and territory transport agencies consider all routes within their regional area, regardless of road ownership (e.g. also consider local government and/or private toll roads). This needs to be considered when determining which routes are to be designated as KFRs based on them meeting the principles for designation as KFRs of national importance.

There is a need for the ability for local government to approach their respective state or territory transport agency and request consideration for a local government road to be included as a KFR where it meets the principles for KFR designation.

The focus is on considering the inclusion in the KFR network of local government roads that are gazetted B-double and PBS routes and provide first and last kilometre access to destinations of national significance.

Recommendation 4: KFR map as a layer on other freight initiatives

Based on findings derived through the workshops it is recommended that consideration be given to making the KFR map available as a layer to the other freight initiative maps.

The lines on the map symbolising the KFR road and rail network needs to be a layer on other freight initiatives. For example, the road component of the KFR map could be a layer on the NSLS framework once developed (the NSLS is not currently proposing to cover rail).

This will enable the performance metrics being developed through the NSLS, and which are applicable to the KFR network, to be displayed on the KFR network as a filtered option.

Recommendation 5: Reference to NSLS framework

It was confirmed through the workshops that the NSLS framework project will categorise the road network according to a wide variety of metrics including productivity, reliability, facilities, amenities, and crash rating, etc. As the framework will guide Australian Government investment decisions, it is relevant to freight operators and road managers.

As a result, the NSLS framework is intended to be the primary tool with which to advocate for funding with respect to upgrading the KFRs.

Therefore, it is recommended that the KFR map refers to the NSLS project for the display of performance metrics.

Recommendation 6: Location, Ownership and Maintenance

Based on a synthesis of the findings from the online survey and workshops, it is recommended that the KFR map continues to be owned and maintained by DITRDCA, with policy responsibility remaining in the Freight and Supply Chain Strategy team, with technical administration and maintenance undertaken by the team with relevant data expertise and responsibility for Freight and Supply Chain Strategy data projects.

Recommendation 7: Updating the KFR map

It is recommended that the KFR map be updated in accordance with the following guidelines:

- Jurisdictions need to continue to review their freight networks. If they wish to determine a route as a KFR, or decide that a route is no longer a KFR, then this must be reflected on the KFR map as soon as possible after the determination has been made. Jurisdictions will be required to notify the Freight and Supply Chain Strategy team of DITRDCA (or any other body determined to be responsible for maintaining the KFR map) to ensure this update can be made.
- For information (excluding HV traffic count) on the KFRs, an update interval of six to 12 months is considered reasonable. This includes the names of the road and rail managers who own the assets.
- For HV traffic count information obtained through jurisdictional estimates and data, an update every five years is considered reasonable.

4. Conclusions

The aim of this project is to review the current use of the KFR map, and how the map can be optimised to communicate with its key stakeholders more effectively. To achieve this, a literature and data review was undertaken, followed by stakeholder consultation to enable a strengths, weaknesses, opportunities and threats (SWOT) analysis to be undertaken on the KFR map. This led to the development of recommendations related to the KFR map for consideration by DITRDCA.

Based on the investigation documented in this report it is recommended that the KFR map continues to be owned and maintained by DITRDCA, with policy responsibility remaining within the Freight and Supply Chain Strategy team, with technical administration and maintenance undertaken by the team with relevant data expertise and responsibility for Freight and Supply Chain Strategy data projects.

Various enhancements to the KFR map are recommended including:

- The provision of contextual information on the KFR map, including an overview of what the KFR visualisation is and its role, along with the role of other freight initiatives.
- The provision of additional information on the KFR map so that the map is a better fit under the National Freight and Supply Chain Strategy and helps to inform improved decision making and investment decisions.

It is recommended that the guiding principles for determining what routes are designated as KFRs of national importance needs to be maintained. However, consideration needs to be given to the inclusion of local government roads which may meet the principles of being designated as a KFR.

Consideration needs to be given to making the KFR map available as a layer to other freight initiative maps. The KFR map needs to refer to the NSLS project for the display of road performance metrics.

The KFR map needs to be maintained and updated in accordance with the guidelines recommended in this report.

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Appendix A   Literature Review Key Findings

A.1   Alignment of the KFR with Key Strategies

A.1.1 National Freight and Supply Chain Strategy

The 2019 National Freight and Supply Chain Strategy establishes an agenda for coordinated and well-planned government and industry action across all freight to 2040 and beyond. It aims to establish a vision where Australian freight and supply chain systems achieve the following goals (Transport and Infrastructure Council 2019a):

1. improved efficiency and international competitiveness
2. safe, secure and sustainable operations
3. a fit-for-purpose regulatory environment
4. innovative solutions to meet freight demand
5. a skilled and adaptable workforce
6. an informed understanding and acceptance of freight operations.

These goals will be achieved by working across the four critical areas of (Transport and Infrastructure Council 2019a):

1. Critical area 1: Smarter and targeted infrastructure investment.
2. Critical area 2: Enable improved supply chain efficiency.
3. Critical area 3: Better planning, coordination and regulation.
4. Critical area 4: Better freight location and performance data.

The National KFR map is intended to help DITRDCA address Critical Area 4: Better freight location and performance data, which outlines that:

> Better measurement of freight and supply chain performance will help government and industry to improve day-to-day operations, identify where action is required to maintain and improve freight outcomes, and evaluate the effectiveness of investments made. (Transport and Infrastructure Council 2019a)

The National KFR map also has linkages to critical area 3 which is associated with better planning, coordination, and regulation. As outlined in Transport and Infrastructure Council (2019b) the desired outcomes associated with critical area 3 are:

- improved planning for moving freight across the nation
- improved heavy vehicle access
- future-focused freight regulation (productivity, safety, security and sustainability)
- planning for a resilient freight system.

A.1.2 DITRDCA Data Strategy

The DITRDCA data strategy for 2021–24 (DITRDC 2021a) was developed to provide DITRDCA with access to data to inform decision making related to achieving the vision of 'connecting Australians and enriching communities and empowering regions.'

The strategic objectives of the data strategy relate to:

- Best-practice governance and management:
  – enrich data quality and value to users
  – transparency in use of data assets
  – manage risks to preserve privacy and security.

- ICT platforms and tools:
  - systems and tools enable data-driven decision-making and improve delivery of functions.
- Culture and capability:
  - target learning and development to lift data capability
  - foster a data culture where collaboration inspires innovation and productivity
  - promote and grow the data agenda.

A.2 The Role GIS Mapping Can Take

Rhind (2017) noted that GIS is a tool that can visually describe a situation over time. GIS is being widely accepted and used as a decision-making tool, especially where it involves bringing together data from various sources. The key advantages of GIS mapping is that it:

- provides an ability to improve organisational data integration
- enables viewing, questioning, understanding, visualising and interpreting data in many different ways which will reveal relationships, trends and patterns
- helps to inform decision making and solve problems through looking at the data in a way which is easily and quickly shared.

The Transportation Research Board (TRB)'s Committee on Multimodal Transportation Requirements for Spatial Information Infrastructure Transportation Research (2004) stipulated that 'geospatial data are a foundation for relevant and critical information for planning, engineering, asset management, and operations associated with every transportation mode at all levels of government and administration.'

The Committee on Multimodal Transportation Requirements for Spatial Information Infrastructure Transportation Research (2004) concluded that GIS needs to be viewed as:

> Infrastructure that is just as necessary as bridges, ports, runways, rails, and roads. Its cost is minimal compared with the potential for what one speaker described as 'billion-dollar bonehead decisions' that could occur without adequate information. To ensure that we make the best decisions possible, we need to support the information infrastructure, or we will find ourselves without the means to make the necessary decisions.

Using geospatial data, decision-makers can formulate new policies and programs. However, 'harnessing the power of geospatial data requires a significant commitment from senior decision-makers to spearhead and then drive the process of gathering, storing, mapping and disseminating data to relevant stakeholders.' (Alliance for Financial Inclusion 2016).

In the USA a static rather than interactive map approach is used (Federal Highway Administration (FHWA) 2020 & 2022). The European Commission (EC) adopts a mixed approach with an interactive map and a static map version used (European Commission 2019; 2021; n.d.).

A.2.1 Need to Enhance GIS Mapping in the Australian Public Service

DITRDC (2021b) found that enhancing the department's GIS capability is critical in terms of building on the department's data strategy (DITRDC 2021a) which outlines steps to support the development of the department's GIS capability moving forward.

The need to enhance the GIS capability will assist the Australian Public Service (APS) in progressing from data to insight, and finally to decisions, in a much quicker timeframe in line with public expectations. Currently the APS is viewed as being in the early stages of digital literacy and behind comparable governments internationally. The significance of this was recognised in the 2026 Spatial Industry Transformation and Growth Agenda (DITRDC 2021b).

The key recommendations arising from the report was that the department:

- adopt cloud computing
- commit to fair data principles
- commit to internally federating data
- commit to externally federating data
- expand data champion roles
- promote GIS skills exchange initiatives
- offer a GIS literacy program
- realign GIS areas to better distribute technical skills
- formalise the process of collaboration to create bespoke solutions
- develop new talent outreach strategies
- change incentive structures to attract and retain talent
- build data coordination into governance.

DITRDC (2021b) recognised that implementing these recommendations will improve communication and efficiency, enable better data management and decision making, align the department's GIS capability with their data strategy, and deliver policy and programs that connect Australians.

Examples identified regarding how combining datasets and displaying the results on GIS maps can be a powerful enhancement tool to the national KFR map are as follows.

Example 1: Analysis of city KFR performance using available data and modelling

The Department of Infrastructure, Regional Development and Cities (DIRDC) (2018a) undertook an analysis of the KFRs within Australia's five largest capital cities. This was to support the inquiry into national freight supply chain priorities (Department of Infrastructure and Regional Development (DIRD) 2017).

The analysis was based on data made available by the Australian Bureau of Statistics (ABS) and the Bureau of Infrastructure, Transport and Regional Economics (BITRE) along with transport network modelling. The transport network modelling reflects changes in transport infrastructure from 2011 (ABS census data) to 2031. The modelling utilises level of service (LOS) categories from 'A' to 'F' to indicate conditions on the road network. LOS 'A' indicates free-flow traffic without delay, and LOS 'F' indicates severe congestion and delays (DIRDC 2018a).

For each city, the details documented included background, KFRs, key freight facilities, network performance, key deficiencies and, in some scenarios, a case study. GIS maps of the city's road network were shown, with the road corridor colour coded to represent different LOS. Overall, the analysis showed that, despite considerable investment from all governments (DIRDC 2018a):

- congestion is occurring on KFRs in all the cities
- commercial vehicle volumes vary considerably between cities
- high commercial vehicle volumes are not always associated with high levels of congestion
- commuter traffic is a major cause of urban congestion.

Example 2: Analysis of KFR using telematics data

Anderson et al. (2019) prepared an Austroads project looking at the KFRs and recorded heavy vehicle usage based on telematics data obtained through the Intelligent Access Program (IAP).

The project demonstrated an ability for telematics data to provide statistical information with respect to the heavy vehicle road use and demonstrates what information can be obtained from telematics information relating to vehicle position by time of day. This can be displayed via GIS maps and dashboards and include information pertaining to (Anderson et al. 2019):

- traffic volume estimates and volume maps (of telematics-equipped vehicles)
- vehicle trip counts by time of day and route (for telematics-equipped vehicles)
- average heavy vehicle speeds and variability of vehicle speeds, by location and time of day

- proportion of journeys by day of week, weekdays and weekends
- travel times for KFRs
- origin-destination trip patterns (for telematics-equipped vehicles)
- measures on the proportion of journeys undertaken on KFRs by trip length
- congested network locations for freight vehicles on KFRs.

This information was based on IAP telematics data which is available to Transport Certification Australia and can be used for this type of analysis, subject to it being aggregated and anonymised. Unfortunately, IAP is a small percentage of the overall heavy vehicle fleet. This is because only performance based standards (PBS) certified vehicles (typically larger and restricted access vehicles) must use IAP. This means that the data is biased towards these types of heavy vehicles and is not fully representative of the overall heavy vehicle freight task. However, it can be used to provide broadly reliable indicators of conditions affecting freight on roads used by a higher volume of heavy vehicles (e.g. heavy vehicle speeds, variability in average speeds and travel times) (Anderson et al. 2019).

Example 3: Using GIS to show road function and customer value

DITRDCA is funding the development of the NSLS framework. As outlined by Yue & Wiley (2021), the intent of the framework is to bring together data associated with road function and customer value and display it in a GIS mapping format.

The roads are assigned a primary function categorisation (based on their ability to link communities and/or serve an economic function). Example primary functions include being defined as either a national road, arterial road, regional road, connector road, access road, local street, or significant place. The roads are also assigned a secondary attribute categorisation which will provide context to the road. This can include attributes related to the (Yue & Wiley 2021):

- degree of movement
- context in which the road is set/located (e.g. urban or rural)
- significance of the road as a place for people to be
- criticality of the road
- priority customers who use the road
- surface type.

An interactive GIS portal can be used to show the primary road function categorisation and secondary attributes along with selected performance metrics on a GIS layered map. This can be set up so that it enables the ability to switch on and off layers and aspects to be displayed. For the performance metrics, Yue & Wiley (2021) proposed that this be based on bringing together a comprehensive set of data from existing, emerging/future, and third-party data sources.

The bringing together of data in a GIS mapping platform will help guide how roads are planned, operated and maintained, and enhance investment decision making. It will provide a framework to measure and display these aspects consistently. This is anticipated to deliver better value for government road expenditure and better outcomes for road users, in addition to being the impetus for funding and tax reform associated with road use (Yue & Wiley 2021).

A.2.2 KFR as a Base Map to Drive Heavy Vehicle Reform

An infrastructure base map and data alignment guidance was identified by Ai et al. (2021) as a key element needed to support heavy vehicle reform. Ai et al. (2021) identified that:

> To collect and report better road-related data, a common way of identifying the location of road segments is needed. Every bit of information about road usage, asset condition and road expenditure can be linked to the location of a road segment, and then displayed using geospatial mapping.

and

> Geospatial data is integral to the management of transport and transport assets across Australia by both government and private organisations. However, there are significant differences in the way geospatial data can be represented, which makes aligning different datasets from different organisations, difficult in a consistent and accurate way..

A.2.3 Current Use of KFR Map

KFR map intended to help inform decision making

The KFR map is used to inform decisions related to freight in Australia and which pertains to infrastructure policy, regulation, planning and operational issues. This includes being able to identify what routes are currently available and to help manage, plan for, and invest in KFRs (National Freight and Supply Chain Strategy Taskforce 2019; Transport and Infrastructure Council 2014 & n.d.).

By being interactive, the intention is that the National KFR map can evolve to reflect changes in freight movements and enable the KFR map to be used by industry (Transport and Infrastructure Council 2014 & n.d.).

The Transport and Infrastructure Council (2014) has agreed to the following:

- That as a minimum, B-doubles will have access to the KFRs. The routes that do not currently provide this level of access will be considered by relevant jurisdictions on a case-by-case basis.
- To increase access above the minimum for high-productivity vehicles, particularly on inter-urban routes. This will be subject to safety and engineering standards consistent with the PBS scheme and subject to the infrastructure being suited to these vehicles. The National KFR map can help identify gaps in access and anomalies across borders.

NLTN provides the funding mechanism

The KFR map is not a mechanism for commonwealth funding of roads. This is the role of the National Land Transport Network (NLTN) which is the land-based freight and passenger network that has been determined by the Minister in the National Land Transport Network Determination 2020 under the National Land Transport Act 2014 (DITRDCA 2022c and Transport and Infrastructure Council n.d.).

The National Partnership Agreement, set up in July 2019, outlines how the Australian Government and the states will work together to deliver infrastructure projects of significance to the Australian community. This covers projects administered under the National Land Transport Act 2014. The level of Australian Government funding is updated each year as part of the Federal Budget. The National Land Transport Act 2014 'provides the mechanism for payment of Commonwealth funding aimed at improving the performance of land transport infrastructure across Australia. These investments assist national and regional economic and social development' (DITRDCA 2021).

The NLTN as of 2020 is presented on the National KFR web app as a layer. The KFR network is more comprehensive than the NLTN, with the vast majority of the NLTN also being declared as KFRs. The focus of the NLTN is on corridors that provide safe and efficient connectivity between capital cities, major centres

and intermodal terminal infrastructure. While similar, the KFR is purely focussed on freight and helps to inform policy decisions related to the networks used by freight (Transport and Infrastructure Council n.d.).

A.3   Improving the Utility of the KFR map

The 2018 Industry Expert Panel led Inquiry into National Freight and Supply Chain Priorities (Department of Infrastructure, Regional Development and Cities (DIRDC) 2018b) recommended that governments:

> Review and map current and proposed future key freight routes for all freight modes to include freight corridors, intermodal terminals, ports, airports, industrial areas, shipping lanes and flight paths, which if not appropriately managed, can create inefficiencies in the freight system. These maps would inform funding decisions and land use planning processes.

The 2018 inquiry (DIRDC 2018b) also recommended establishing 'a data gathering and performance review mechanism focused on travel times and reliability on KFRs and the efficiency of the interfaces at freight terminals with routine public reporting of performance over time.'

A previous review by the National Freight and Supply Chain Strategy Taskforce (2019) noted that further work was needed to develop and promote the maps 'so that the maps achieve their greatest potential as a potent evidence-base and inquiry tool for policy, investment and regulatory reforms.'

This could be addressed through the provision of (National Freight and Supply Chain Strategy Taskforce 2019):
- Layered information. Detailed information applicable for transport agencies and industry, such as secondary tiers of routes, volume and commodity data, along with customer service features such as rest stops.
- Proposed future routes. Changes in government priorities for proposed future investments could be displayed in an online map as a separate layer to the 'KFRs' layer which applies to existing infrastructure only.
- Expanded use of the map. Other stakeholders could benefit from an updated map. This could include land use planners; local government; property and business groups; along with the wider consultancy, research and web application designer industry.

The National Freight and Supply Chain Strategy Taskforce (2019) made recommendations with respect to the updating the National KFR map. This included:
- The KFR map needs to have more and better geographical information (e.g. spatial info, not just points or lines) on industrial areas, intermodal terminals and distribution centres, including current and future land use planning.
- The map needs to have more information on the KFRs identified. For example:
  – if it is a federal, state or local council-owned road
  – information on current and future investments into the KFRs
  – detailed inventory information (e.g. number of lanes, lane width) and condition information (e.g. roughness)
  – whether the routes are designated as being KFRs by legislation or policies
  – airport freight locations
  – critical links to key freight networks.
- The KFRs could benefit from identifying:
  – freight-generating areas (e.g. agricultural areas of significance)
  – volume, type and value of freight travelling on the routes.
- The map could be combined with one of the other government/regulator freight mapping initiatives as an input or layer to the other map. Appendix A.6 lists other identified freight mapping initiatives.

A.4 Resilience

From a transport, planning and assessment aspect, resilience has three main focuses (Weilant, Strong & Miller 2019):

1. reducing the likelihood of an event while increasing the ability of the road network to be able to manage the event if it occurs, and/or minimise the impact
2. increasing the adaptability of the system while maintaining function if an event occurs
3. reducing recovery time back to normal function after the event.

Esri (2021) provided some case studies of how GIS have been used to improve the resiliency of transportation networks. It outlines that state road agencies in the United States are using graphical representations of the road networks to assess the roads in terms of their vulnerability due to environmental risks and consequences. This enables road agencies to appreciate the cost to the road agencies and the users of the road if the road is inoperable. This may include the identification of low-lying land near rivers or the ocean, levels of precipitation, storm intensities or even the extremes of temperature.

Infrastructure Australia's (2021) pathway to infrastructure resilience advisory paper identified that 'the most significant opportunity to consider and achieve resilience is in the infrastructure planning phase. The decisions made at this stage establish the trajectory of all the dimensions of the infrastructure lifecycle.'

Examples of national data sources that inform resilience decisions include the Australian National Map which is an online map-based service allowing access to spatial data from government agencies. Datasets that are important for understanding shocks, stresses and vulnerability include data on natural hazards, previous disaster events, the location of infrastructure assets, and census data.

The Australian Transport Assessment and Planning Steering Committee (2019) provides guidance on flood resilience initiatives in transport. This is to identify measures to mitigate the impact of flooding on relevant modes being assessed through initiatives such as raising or replacing bridges, raising pavements, and/or rebuilding roads on a new alignment. When developing initiatives, the locations of likely flooding needs to be determined and the extent of the work required to mitigate the impact understood. Initiatives can be hard to appraise due to the lack of data. This includes data on user behaviour and decision making in response to flooded roads.

Manders et al. (2016) looked at the development of risk indicators to support the evaluation of routes which may act as lifelines. The lifeline routes are road routes which do not typically have large traffic volumes but have a high value for the communities that they support. It was identified that the lifeline framework was unlikely to provide a basis for prioritising high traffic volume sites, such as KFRs. The framework is instead a tool for prioritising investment in routes identified as providing a lifeline. The framework considers the following:

- the presence or absence of alternative freight routes, and the quality of alternative routes for the transport task
- the size and nature of the communities serviced
- the history and potential of future road/route closures
- the impact of the closure on the community and industry reliant on the road
- the likelihood that alternative freight routes are available when needed, considering weather and incident events (i.e. would they be impacted as well).

A.5   Heavy Vehicle Access

Heavy vehicle access is critical for supply chains. The useability of KFRs is diminished if freight cannot get from origin to destination due to first and last kilometre access issues. The DIRDC (2018b) outlined several recommendations relating to heavy vehicle access and KFRs. They include:

- Review supply chains and identify any points on the KFRs which could be significantly impacted by routes which are disrupted. In the absence of alternative supply chain options, enable mitigation strategies to be put in place to ensure ongoing freight accessibility.
- Local governments need to work with their state and territory counterparts to develop coordinated urban freight plans for major cities, to ensure city-wide freight outcomes are met, such as access to KFRs, last kilometre access, buffers and industrial land preservation.
- Target Commonwealth investment towards KFRs and the associated first and last kilometre access roads, with investments aligned to the National Strategy
- Expand current infrastructure investment programs to address infrastructure issues that are preventing high-productivity vehicles and over-size and over-mass vehicles accessing KFRs and freight facilities. This may include expanded support for local government assessment programs and investment in bridges, culverts and degraded roads.

A.6   Freight Mapping Initiatives

There are various national freight mapping initiatives that are operational across Australia. Table A.1 presents an overview of the identified datasets.

While state-level data is available, nationally consistent datasets are hard to find. This has led to several government and organisational initiatives to develop harmonised datasets (e.g. the National Freight Data Hub).

In addition to the freight mapping initiatives identified in Table A.1, DITRDCA is also developing the NSLS framework as identified in Section 2.4.1.

The Commonwealth Scientific and Industrial Research Organisation (CSIRO) also has the Transport Network Strategic Investment Tool (TraNSIT) model that provides a detailed GIS map of routes and costings across Australia's entire agricultural supply chain (National Freight and Supply Chain Strategy Taskforce 2019). An overview of TraNSIT is presented in Appendix A.6.1.

Table A.1:   Identified freight mapping initiatives

Dataset group	Type	Description
National Road Datasets	National Land Transport Network (NLTN) – Road	The 2020 NLTN for roads is included as a layer on the KFR map, although the difference between the KFR and NLTN is not clearly articulated.
	Geoscience Australia (GA)	This dataset identifies national major roads within Australia. This is for general traffic and considered separate to freight routes of national significance.
		This dataset is much denser than the KFR map; however, it includes some roads which are considered KFRs in Northern WA and NT but are not a part of the GA dataset.
	NHVR route planner	Designed as a route finder and contains many data layers that assist with heavy vehicle routing. Many of the layers relate to vehicle restrictions and road ownership.
	Open Street Map	Open-source mapping services contains a detailed road network. It represents a robust map of the road network which can be used for navigation purposes. It includes road hierarchy information.
	Other map providers (e.g. HERE, StreetPro Nav, Public Sector Mapping Agencies (PSMA) Australia, and TomTom)	Provides comprehensive maps of the road network designed for vehicle navigation and routing.
National Rail Datasets	Geoscience Australia	Contains most of the KFR rail lines with a few minor differences compared to the KFR map around Mackay, Queensland, the Port Headland region in WA and near Geraldton, WA.
	National Land Transport Network (NLTN) – Rail	Outlines the rail component of the NLTN.
		This is only available as a PDF map.
National Freight Key Location Datasets	National Freight Data Hub	Centralised Australian freight data provided in a single location with significant overlap with the National KFRs map. As of July 2022, a prototype website (DITRDCA 2022d) has been released with most datasets referring to other jurisdictional data sites. Some key datasets it hosts or links to include the heavy vehicle infrastructure rating asset register, heavy vehicle rest areas, harmonised traffic counts (sample data only) and the National KFRs map.
	Australian Bureau of Statistics (ABS) significant urban areas	Spatial datasets relating to population centres. One is the greater capital city statistical areas. The other is the significant urban areas (area with a population greater than 10,000) dataset (ABS 2022).
	Australian Customs and Border Protection Service map of ports	The only national dataset available for ports outside of the KFR dataset. The port dataset highlights many KFRs destinations and overlaps with many of the ports in the KFRs dataset.
	Geoscience Australia airport dataset	Datasets of 326 airports (including name and location) around Australia.
	OurAirports airport dataset	Dataset of 2,339 airports and heliport locations around Australia.

A.6.1 TraNSIT Overview

Developed by the CSIRO, the Transport Network Strategic Investment Tool (TraNSIT) model provides a detailed GIS map of routes and costings across Australia's entire agricultural supply chain (National Freight and Supply Chain Strategy Taskforce 2019).

TraNSIT is not a database of road networks (however, it would use one). Rather, it is a model source which provides vehicle trip information based on origin-destination style data. This is for approximately 70% of Australia's inbound and outbound supply chains (approximately 65% of road, and 95% of rail freight transport). One example of a potential use-case for this data can be seen in the Supply Chain Transport and Logistics Dashboard (CSIRO 2022b)

As captured by the National Freight and Supply Chain Strategy Taskforce (2019), TraNSIT highlights key areas where infrastructure investment would be most beneficial (but not the cost of required infrastructure investments). It includes information such as:

- vehicle trips across thousands of supply chains between production and domestic and export markets
- the least-cost travel path for each supply chain
- vehicle configuration permissions
- accommodating road conditions
- driver fatigue regulations
- vehicle decoupling costs.

TraNSIT has already been used to inform Government decisions by (National Freight and Supply Chain Strategy Taskforce 2019). This includes:

- informing 60 road upgrade submissions for the Northern Australia beef roads fund
- informing the $3.5 billion Roads of Strategic Importance program
- assisting with the planning of 'future freight' at a regional scale for various locations across Australia
- identifying capacity constraints to air freight for horticulture in Australia
- estimating average transport reduction costs of $76 per tonne for shifting transport of east coast agriculture from road to rail, or $31 per tonne to shift from coastal rail to inland rail
- estimating transport cost (plantation to processing or port) of $23 billion for 800 million cubic metres over 25 years, for all Australia's plantation forestry
- providing the capacity to estimate the impact of road improvements for the Australian tourism industry
- providing government with the capacity to test infrastructure and regulatory scenarios.

The TraNSIT model is not public facing. However, the CSIRO (2022b) provides a public facing 'Supply Chain Transport and Logistics Dashboard' which is powered by TraNSIT. This dashboard provides key statistics related to supply chain logistics for different Australian agricultural commodities.

A.7 Key Themes Identified Through the Literature Review

The literature and data review component of the project identified the following:

1. The KFR map could be improved to better address the National Freight and Supply Chain Strategy. This could be through:
   a. rationalising and combining multiple datasets associated with freight related infrastructure
   b. layering on additional information to the KFR map to provide enhanced information leading to greater informed decision making.
2. Bringing data together in a GIS mapping platform can help guide how roads are planned, operated, and maintained, and enhance investment decision making. This is anticipated to deliver better value for government road expenditure and better outcomes for road users. This could be through:

a. keeping the KFRs within the department but improving its utility by leveraging off and reusing existing and available datasets in alignment with the department's data strategy and intention to enhance the department's GIS capability
b. capturing local government roads that may not be included in the KFR map to ensure that local government roads that are of national significance are included as KFRs on the map
c. improving the utility of the map by adding additional data to the KFRs
d. clearly outlining the purpose of the NLTN as a layer of the National KFR map, including outlining how it is different to the KFR map.

Appendix B Stakeholder Consultation

B.1   Structure

The stakeholder consultation associated with this project comprised the following elements:

1. online stakeholder survey
2. virtual stakeholder workshop with state and local road agencies and federal body agencies
3. virtual stakeholder workshop with industry representatives.

Key information on each aspect follows. The key themes identified through the stakeholder consultation are listed in Appendix B.2.

B.1.1 Online Stakeholder Survey

An online stakeholder survey was developed and circulated to over 70 contacts selected as either having an interest in the KFR map or a potential interest in the KFR map.

The online survey was available for completion for approximately 6 weeks from June through to August 2022. A total of 38 respondents from 29 organisations representing a wide range of groups completed the survey as outlined in Table B.1. Several organisations had multiple representations with respect to the completion of the survey.

Table B.1:   Online stakeholder survey participation

Group	Organisation represented
Federal departments	1. Emergency Management Australia/Department of Home Affairs x 3 2. Department of Infrastructure, Transport, Regional Development and Communications and the Arts x 3
Federal heavy vehicle regulator	3. National Heavy Vehicle Regulator (NHVR) x 2
State and territory departments/road transport agencies	4. Victorian Department of Transport (Vic DOT) x 1 5. NT Department of Infrastructure Planning and Logistics/NT Government Civil x 3 6. Transport for NSW (TfNSW) x 1 7. Department of Planning, Lands and Heritage Western Australia (DPLH WA) x 1 8. Main Roads WA x 1 9. Queensland Department of Transport and Main Roads (TMR) x 1
Local government associations, etc.	10. Australian Local Government Association x 1 11. Local Government Association of Tasmania x 1 12. Municipal Association of Victoria x 1 13. WA Local Government Association x 1 14. Local Government Association of Northern Territory x 1 15. Local Government NSW x 1
Researcher	16. Commonwealth Scientific and Industrial Research Organisation (CSIRO) x 1 17. Austroads x 1 18. Australian Road Research Board (ARRB) x 2
Industry associations	19. Australian Trucking Association x 1 20. Queensland Trucking Association x 1 21. Australian Livestock and Rural Transporters Association x 1 22. NT Road Transport Association x 1 23. Tasmanian Transport Association x 1 24. Australian Logistics Council x 1 25. Western Roads Federation x 1
Rail representation	26. Australian Rail Track Corporation x 1 27. Australasian Centre for Rail Innovation x 2
Industry	28. Diamond Bros x 1 29. Non-disclosed transport operator x 1

The survey involved 18 questions relating to the KFR map and the use of the KFR map. There were 15 questions, with an additional three embedded questions depending on the response to other questions.

The questions were predominantly multiple choice, with a few free text questions. The key themes covered through the survey are summarised in Table B.2.

Table B.2:   Key themes and topics covered in the survey

No.	Theme	Topic	No of questions
1	Current use	• Involvement with freight and freight routes. • Awareness of the KFR map. • Level of use of the KFR map. • Perceived value of the KFR map by the user. • Reason to use the KFR map. • Digital device to access the KFR map.	7
2	Future governance	• Ownership and maintenance of the KFR map. • Location of the KFR map. • Perceived value of the KFR map in its current form in general. • Future governance.	4
3	Potential dataset improvements	• Routes and infrastructure that need to be included in the KFR map. • Data that needs to be included in the KFR map. • Functionality that the KFR map needs to have.	7

B.1.2 Workshop for Road Agencies

A workshop for road agencies was held on 29 August 2022. A total of 27 participants were in attendance representing 12 organisations/departments as listed in Table B.3.

Table B.3:   Agencies workshop participants

Group	Organisation
Researcher	1. ARRB (hosts and chair of the workshop) x 2
	2. CSIRO (Transport Network Strategic Investment Tool (TraNSIT)) x 3
Federal departments	3. DITRDCA x 8
	4. DITRDCA (Bureau of Infrastructure and Transport Research Economics (BITRE)) x 3
State road transport agencies/state departments	5. Vic DOT x 1
	6. Transport for NSW (TfNSW) x 2
	7. Queensland Department of Transport and Main Roads (TMR) x 3
	8. Main Roads WA (MRWA) x 1
	9. NT Government x 1
	10. Department of Planning, Lands and Heritage WA x 1
Federal heavy vehicle regulator and certification bodies	11. NHVR x 1
	12. Transport Certification Australia (TCA) x 1

The workshop covered four themes with 13 questions as summarised in Table B.4.

Table B.4:   Key themes and topics covered in road agencies workshop

No.	Theme	Topic	No of questions
1	Purpose and features	• Purpose of the KFR map relative to other freight initiatives. • Priority KFR map features.	4
2	Governance and KFR definition	• Hosting and maintaining the KFR map. • Principles for defining the KFR.	2
3	Infrastructure resiliency	• KFR map's role in informing policy on resiliency.	3
4	Overlays	• Priority KFR map layers and maximising the value of available datasets.	4

B.1.3 Industry Workshop

The industry workshop was held on 31 August 2022. Ten participants were in attendance representing the six organisations listed in Table B.5.

Table B.5:   Industry workshop participants

Group	Organisation
Researcher	1. ARRB (hosts and chair and the workshop) x 2
Federal department	2. DITRDCA x 3
Rail representation	3. Australian Rail Track Corporation (ARTC) x 2
Industry association	4. Australian Trucking Association (ATA) x 1
	5. Queensland Trucking Association (QTA) x 1
	6. Tasmanian Transport Association (TTA) x 1

Additional industry associations were invited; however, they were unable to connect in on the day.

The workshop addressed four themes with ten questions as summarised in Table B.6.

Table B.6:   Key themes and topics addressed in industry workshop

No.	Theme	Topic	No of questions
1	Clarity of purpose	• Industry use of the KFR map. • Priority KFR map features.	3
2	Priority KFR map features	• Policy development and advocacy.	2
3	Policy	• Information on infrastructure resiliency, performance, and access, etc.	5

B.2   Key Themes Identified During the Stakeholder Consultation

The key themes identified during the stakeholder consultation that relate to the KFR map include:

1. There is reasonable awareness of the KFR map; however, the KFR map is rarely used.
2. The KFR map must continue to be housed in its current location and continue to be owned and maintained by the Freight and Supply Chain Strategy team within DITRDCA.
3. The current KFR defining principles are considered adequate; however, understanding why a route is designated by jurisdictions to be a KFR would be worthwhile.
4. The KFRs must not be limited to state-owned routes but also include local government roads where they may meet the principles to be designated as a KFRs.
5. The purpose of the KFR map is to assist in investment decision making. The KFR map is not the sole tool used by governments to make investment decisions.
6. The NSLS framework will be the primary tool used to inform decision making once developed, as it will contain metrics of the road network that are important to road users, including freight. Industry will also look to the NSLS framework as the main tool they will refer to for advocacy.
7. The KFR map could be made more useful by providing further information about the KFRs on it. However, the KFR map must be kept simple and additional information added must be targeted. Suggestions of additional targeted information to include on the KFR map include:

   a. Gazetted road network.
   b. Road surface status (sealed/unsealed).
   c. Rest area serviceability.
   d. Railway level crossing locations and type.
   e. Mobile phone network coverage.
   f. HV volume information.
   g. Indication of why a route is part of the KFR network.
   h. Rail gauge.
   i. Ability to accommodate double stacked trains.
   j. Current and yet-to-be-completed and potential future KFR network.

  k. Intermodal facilities.

  l. Areas/regions at high risk to natural disasters.

  m. Local government areas.

  n. Key commodity producing areas of national significance.

8. Rather than bringing data to the KFR map that is in addition to the targeted information outlined in item 7, it would be more useful to add the KFR map to the other freight initiative maps. For example, the lines on the map symbolising the KFR road and rail network could be a layer on the NSLS framework, once developed.

9. To ensure the relevancy of the KFR map, the KFR map needs to be kept up to date as follows:

  a. As soon as a route is determined to be a KFR and part of the KFR network it must be defined as a KFR.

  b. Information (excluding HV traffic count) on the KFRs needs to be updated every 6 to 12 months.

  c. HV traffic count information obtained through jurisdictional estimates and data needs to be updated every five years.

10. There is a need for the KFR map to include an 'information page'. The information page must provide context on the KFR map.

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