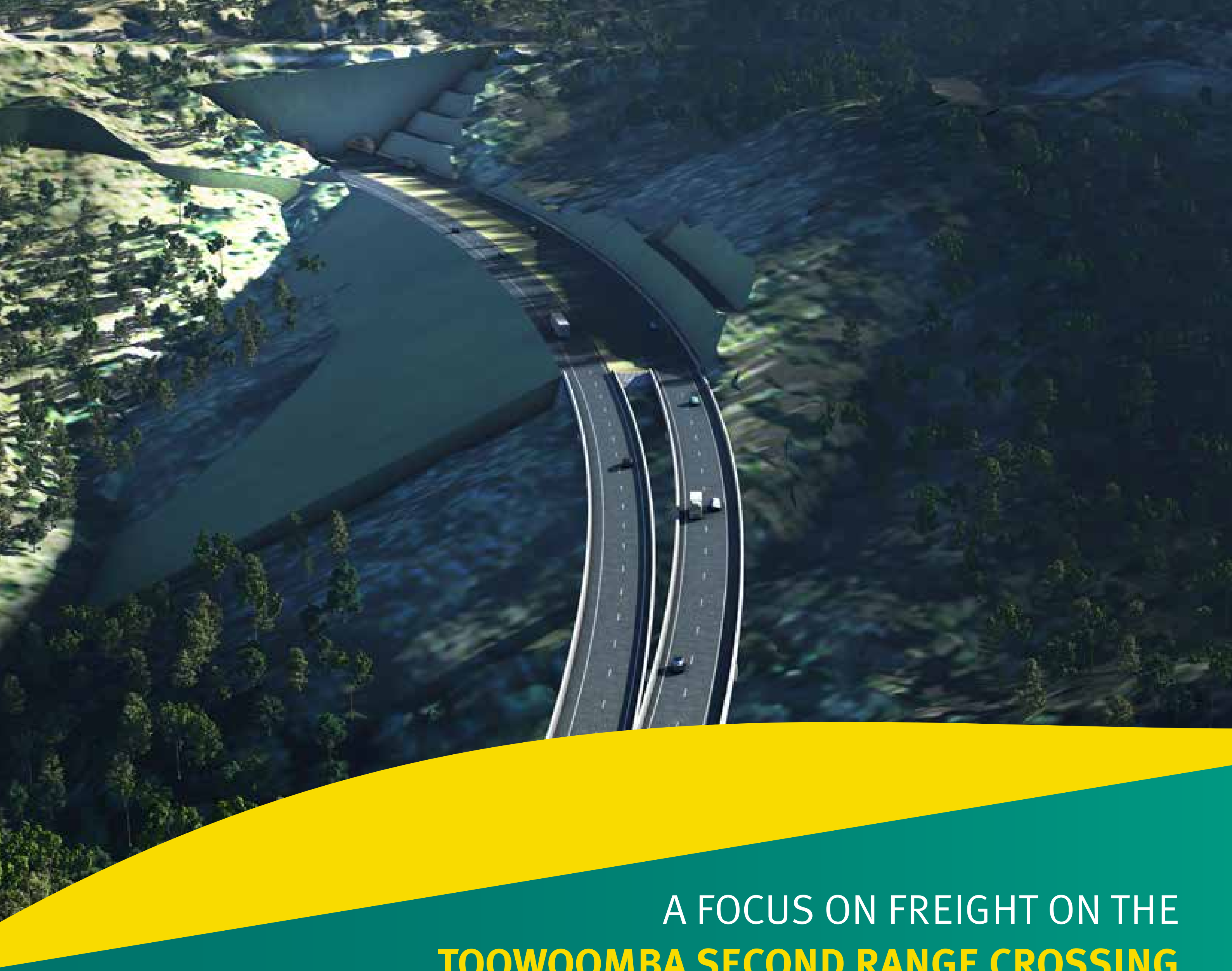

A FOCUS ON FREIGHT ON THE TOOWOOMBA SECOND RANGE CROSSING (TSRC) September 2014

QTLC

QUEENSLAND TRANSPORT AND LOGISTICS COUNCIL

The Chief Executive Officer
Queensland Transport and Logistics Council
PO Box 16091, CITY EAST QLD 4002

REPORT PREPARATION

This report has been prepared by EsSCO PTY LTD
with edit and design by pH creative.

TEL: 0438 153 109


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Foreword

As Queensland's peak freight transport and logistics advisory body to government, the Queensland Transport and Logistics Council (QTLC) is committed to representing industry to influence policy, regulation, infrastructure planning and investment to achieve sustainable and productive supply chains.

Central to this remit, the QTLC seeks to adopt a proactive approach in contributing to the freight agenda within Queensland, through the development and progression of various working papers and reports that will document the freight and logistics issues for both industry and government.

In line with this objective, the QTLC have developed of a series of reports focusing on Queensland supply chains.

As Queensland seeks to increase its economic competitiveness in the global marketplace, it is critical that the productivity of our supply chains are optimised through the ongoing development of an efficient and resilient freight system.

To better understand supply chains in Queensland, the drivers of change, and the policy and infrastructure requirements to support future growth, the QTLC has undertaken an analysis of the global supply chain characteristics and policy imperatives driving economic development and growth and how these relate to proposed and existing infrastructure.

This report focuses on the Toowoomba Second Range Crossing (TSRC). Queensland's highest infrastructure priority, the state and commonwealth governments have committed in excess of $1.6 billion to the project and the procurement process for construction is progressing.

The existing crossing of the Great Dividing Range is plagued by congestion, poor road safety and slow transit times caused by steep gradients and tight curves. Despite these limitations, the current range crossing is the gateway to Brisbane based domestic and export markets and is used extensively be a diverse range of supply chains including key industry sectors such as livestock and meat, cotton, grain and horticulture.

The QTLC's *Strengthening Queensland's Supply Chains* report recommends that the design of the TSRC reflect end-to-end supply chain drivers and enhance productivity through improved alignment with connecting networks.

To this end, the QTLC examined the supply chain benefits of the TSRC and the potential for productivity improvement given a defined level of access, including enabling access to other strategic freight routes.

As expected, the QTLC analysis found that the TSRC will likely facilitate economic growth through enhanced productivity, reduced travel times, reduced congestion and improved travel time reliability. The analysis also identified a number of opportunities to enhance productivity and future proof the infrastructure so that it can meet growth in economic development and freight demand.

The realisation of these proposed benefits, however, will be greatly improved by taking a whole of supply chain view, understanding and meeting industry requirements, and by undertaking ancillary works to align connections east and west of the TSRC.

While not definitive on these matters, the QTLC commends this report to the body of work seeking to optimise the efficiency of the TSRC through a constructive consideration of related supply chain and freight system matters.

About the Queensland Transport and Logistics Council (QTLC)

The Queensland Transport and Logistics Council (QTLC) is a cooperative industry and Government advisory body that provides advice to industry stakeholders and state and federal governments on the development, planning, regulation and operation of freight and logistics transport, infrastructure and services in Queensland.

The QTLC is jointly funded by the Queensland Department of Transport and Main Roads (TMR) and the Australian Government's Department of Infrastructure and Regional Development (DIRD).

As the peak industry body representing the views of the freight transport and logistics industry, the QTLC advocates for the provision of infrastructure, regulation and policy that will support sustainable freight transport and logistics in Queensland.

The QTLC supports the efficient movement of freight in order to support sustainable and productive economic development and prosperity by pursuing:

- appropriate and ongoing investment in supply chain infrastructure
- integrated regional and urban planning frameworks that secure land for current and future freight corridors
- an access policy and regulation environment that facilitates productivity and innovation
- efficient integration and linkage of freight and logistics systems across the whole supply chain.

The QTLC works towards operational and strategic solutions to impediments and issues within the freight supply chain with both long term and immediate benefits for industry.

More information on the QTLC and its activities can be found at www.qtlc.com.au or email admin@qtlc.com.au

Glossary

CBD	Central business district
CSG	Coal seam gas
CWEA	Charlton Wellcamp Enterprise Area
CQTSCS	Central Queensland Transport Supply Chain Strategy
DIT	Department of Infrastructure and Transport
EOI	Expressions of interest
FMCG	Fast-moving consumer goods
GRP	Gross Regional Product
GVM	Gross vehicle mass
HML	Higher mass limits
HVAP	Heavy Vehicle Action Plan
KPI	Key performance indicator
LNG	Liquefied natural gas
NLFS	National Land Freight Strategy
NSW	New South Wales
NT	Northern Territory
NRMA	National Roads and Motorists Association
OSOM	Over-size over-mass
PBS	Performance-based standards
PQ	Projects Queensland
PPP	Public/private partnership
QTLC	Queensland Transport and Logistics Council
SEQ	South East Queensland
TEU	Twenty foot equivalent unit
TMR	Queensland Department of Transport and Main Roads
TRC	Toowoomba Regional Council
TSBE	Toowoomba Surat Basin Enterprise
TSRC	Toowoomba Second Range Crossing

1 Executive summary

As Queensland seeks to increase its economic competitiveness in the global marketplace, it is critical that we have a freight system that supports resilient, effective and efficient supply chains, and which can meet the current and future demands.

To that end, the QTLC has undertaken an analysis of the global supply chain characteristics and policy imperatives driving economic development and growth, to understand how these relate to proposed and existing infrastructure.

Objective

In summary, QTLC's objective is to:

Better understand supply chains in Queensland, the drivers of change, and the policy and infrastructure requirements to support future growth.

The analysis from the project is presented in three reports, focusing on:

Future freight in Queensland from a global supply chain perspective

This examines major Queensland supply chains, global supply chain trends, policy imperatives and freight infrastructure. Details of 11 of Queensland's major supply chains is provided through Supply Chain Perspectives, with this information informing the subsequent investigations.

The Toowoomba Second Range Crossing *(this report)*

Using information derived from the Supply Chain Perspectives and an industry forum, this report provides an examination of the supply chain benefits, freight efficiency opportunities and broader economic opportunities provided by the TSRC.

Queensland's Inland Highway (Queensland Freight Spine)

This report identifies a flood resilient inland freight route, connecting South East Queensland to northern Australia, and to the key nodal infrastructure that supports Queensland's major supply chains.

The focus of this document is the *Toowoomba Second Range Crossing (TSRC),* with the overall objective to:

Examine the supply chain benefits of the TSRC and the potential for productivity improvement given a defined level of access, including enabling access to other strategic freight routes.

The TSRC is a 42 km road corridor, running north of Toowoomba from the Warrego Highway, west of Helidon Spa, to the Gore Highway, around 17km south-west of Toowoomba. The TSRC will provide commercial vehicles with an alternative crossing of the Great Dividing Range, and aims to improve driver safety, relieve pressure on Toowoomba's roads and enhance liveability for the city's residents.

The TSRC has long been one of the highest infrastructure priority for Queensland. The existing range crossing has been rated as one of the worst performing sections of road infrastructure in Queensland, with high levels of congestion, frequent road closures and poor road safety.

Recently, the Commonwealth and Queensland Governments committed funding in excess of $1.6 billion to the project. The procurement process requires potential proponents to base their response on a reference design developed for the TSRC, and then refine that design.

Based on the reference design, the nominated expected benefits of the TSRC are:

- reduced travel time and greater travel time reliability
- capacity to accommodate regional economic growth
- redirection of heavy vehicles away from the existing range crossing
- a safer and less congested route
- improved freight efficiency, resulting in a reduction in the number of movements.

Using the reference design as a defined level of access, the QTLC undertook an analysis of these benefits by industry, identifying opportunities for enhancing productivity. The purpose of this analysis is to ensure that the relationship between the design of the TSRC and the benefits conferred to industry are well understood and that any opportunities to enhance productivity, thereby future-proofing this key piece of freight infrastructure, are identify and explored.

The methodology for this analysis included developing Supply Chain Perspectives for 11 of Queensland's major supply chains. These 'Perspectives' outline movement patterns, freight volumes and nodal activity requirements for the major supply chains. With that understanding, the QTLC convened an industry forum with transport industry representatives, including operators, with a specific focus on the TSRC.

The benefits of the TSRC were analysed separately according to industry/sector and supply chain.

In summary, the industry/sector analysis found that:

- The TSRC will likely reduce travel times and improve travel time reliability. There are concerns, however, regarding the potential for congestion at the proposed signalised intersections/interchanges, which may erode any travel time savings.
- There will likely be a reduction in operating costs, however, evidence suggests it may not reach the nominated published benefit of 25%.
- The TSRC is expected to accommodate regional growth through improved efficiency resulting from increased load mass, a reduction in the number of movements, and cycle time improvements. The uptake of heavier units of movement (i.e. 40-foot containers) by key industries in the region – meat, cotton and grain – will be influenced by HML access on connecting networks. The higher mass capability provided by the TSRC will likely be of little benefit to the high proportion of fast moving consumer goods (FMCG) that are constrained by limitations at nodal points in urban locations.
- The TSRC will likely reduce congestion and improve safety in Toowoomba as a result of traffic being diverted away from the existing crossing to the TSRC.
- Based on the reference design, which excludes some categories of bulk dangerous goods and fuel in the TSRC tunnels, an estimated 50-75 dangerous goods movements per day will continue to use the existing crossing. The design of the tunnels will also likely result in less than 30 OSOM movements a day continuing to use the existing crossing or transit via the Cunningham Highway. This could be reduced to less than 15 movements a day if the tunnels were able to accommodate a 5.6m load height.

The supply chain analysis considered the role of nodal activity of each sector, as well as access to the TSRC from the east and west, to identify factors that will impact potential benefits to each industry and of the TSRC overall.

From these two approaches, a number of opportunities to enhance productivity and remove impediments to efficiency emerged, including the following:

- Better alignment between infrastructure planning and access arrangements for networks connecting to the TSRC.
- Nominating PBS Level 3 as the reference vehicle classification to encourage vehicle innovation, as opposed to restricting vehicles to a B-Triple combination (the current nominated reference vehicle). Whilst not explicit in the reference design, we understand from discussions with Projects Queensland, that it intends to accomodate all PBS level 3 vehicles.
- If access arrangements are aligned, decoupling yards would no longer be required to the west and the east of the TSRC.

To ensure future-proofing, beyond the defined level of access of the reference design, the following is proposed:

- pavement strength be designed to ensure the majority of HML and OSOM loads can utilise the TSRC
- height clearance be increased to 5.6 m in the tunnels to increase the OSOM movements to 90% from the forecast 78% at 5.3 m
- to increase height clearance, innovative designs be developed for the signage and fans located in the top section of the tunnel
- allowance in tunnel width to provide a road shoulder for vehicle run-off
- signalling and intersections be designed to cater for the PBS Level 3 type vehicles
- tunnels be equipped with fire-suppression and emergency response resources to allow fuel and bulk dangerous goods through the TSRC tunnels.

2 Background

2.1 Context

The Toowoomba Second Range Crossing (TSRC) has long been one of the highest infrastructure priority for Queensland. The existing range crossing has been rated as one of the worst performing sections of road infrastructure in Queensland. Current issues include:

- congestion, with more than 23,000 vehicles crossing the range daily, including 3,500 heavy vehicles[1]
- poor road safety, with traffic incidents doubling since 2010
- frequent road closures resulting in transit delays
- steep gradients (10%), with tight curves, causing slow ascent and decent speeds by larger freight vehicles.

The existing crossing is used by a diverse range of supply chains that operate in regions west of Toowoomba and link to South East Queensland.

The foundation report of this project, titled *A Focus on Future Freight in Queensland from a Global Supply Chain Perspective,* provides a narrative of the overarching policy frameworks related to freight. Further, a detailed appraisal is provided in the section *Freight Transport in Queensland, Legislative & Policy Background & Context.* [2]

The initial inputs to the TSRC investigation were based on the preparation and referencing of information[3] relating of 11 industry/sector specific Supply Chain Perspectives. [4] These Perspectives also informed the above report.

As implied in the name, the TSRC will be the second crossing of the Great Dividing Range linking Toowoomba, Darling Downs and Maranoa regions with the major population centres of South Eastern Queensland (SEQ). The TSRC will also link SEQ to all main inland freight routes. The existing range crossing, while being upgraded at the time of developing this report, has inherent issues for heavy vehicle use. These include the steepness of the grade, tight horizontal bends, and with the western access and egress points being via the main streets of Toowoomba. The safety record on this corridor is also recognised as a significant issue [5].

1 Queensland Traffic Census 2012, Queensland Department of Transport and Main Roads

2 Freight Transport in Queensland, Legislative & Policy Background & Context - Helen Stehbens July 2014

3 The reference sources include state and federal government strategic plans, government agency plans in relation infrastructure development and/or improvement, the Australian Bureau of Statistics, industry associations and a wide range of industry research documents.

4 Future Freight in Queensland from a Global Supply Chain Perspective, Report 1 QTLC August 2014

5 Warrego Highway Upgrade Strategy – Connecting Queensland's Regions February 2012

As the centre of a major regional population base, Toowoomba is a hub for freight activity, including a high volume of fast moving consumer goods (FMCG).

With the exception of coal, which is moved exclusively by rail, road transport is the major transport mode for large freight generating industries in the region. There are more than 3,500 truck movements a day across the range.

The National Land Freight Strategy (NLFS) has designated Toowoomba as a 'hub' for many of the key freight routes identified by Infrastructure Australia. These freight routes include the main inland corridor from Melbourne through the central west of New South Wales and those connecting the south-west, west, north-west and far north of Queensland and the Northern Territory.

2.2 Range crossing and economic contribution

Freight movements supporting many of Queensland's key industry sectors - including livestock and meat, cotton, grain, horticulture, coal seam gas (CSG) extraction and mining - must cross the range to move goods from their point of origin to production and export facilities, markets and work sites. The following movement profile from the Supply Chain Perspectives is based on daily heavy vehicle traffic crossing the range:

Table 1: Range crossing movements

Sector	Daily movements
Primary production	41.9%
General freight	49.2%
Fast-moving consumer goods (major retailers)	3.2%
Fuel transport	3.0%
OSOM	2.7%

CSG sector investment continues in the region as well as growth in traditional regional industries. The region also has some of the largest coal mine expansion projects proposed for Queensland.

Agriculture, currently worth an estimated $13.7 billion a year to the Queensland economy, is a key growth platform for both the Queensland and Commonwealth Governments. The Queensland Government has the vision to double agricultural production by 2040.[6] The Commonwealth Government has a clear focus on developing northern Australia[7], with a large component of this strategy relating to inland and northern Queensland. The road network that crosses the range is a vital link in agricultural supply chains as demonstrated below:

6 Queensland's Agriculture Strategy 2013, Department of Agriculture, Fisheries and Forestry, Queensland Government

7 2030 Vision for Developing Northern Australia, Brian Loughnane, Liberal Party, June 2013

Table 2: Range crossing and economic contribution[8]

Supply chain	Darling Downs/Maranoa Balonne/South West Queensland	Queensland (total)	Percentage reliant on range crossing
Cattle (head)	2,774,648	12,611,874	22.00%
Total livestock (head)	9,910,959	37,092,989	26.72%
Meat processing (head)	2,140,000	3,577,000	60.00%[1]
Horticulture (tonnes)	193,062	1,089,079	17.30%
Seed cotton (tonnes)	793,951	889,346	89.27%
Total grains (tonnes)	2,363,592	3,079,334	76.76%

1 Australian Bureau of Statistics, Report 71210DO013-201011 Agricultural Commodities, Australia 2010-11

This focus will have significant implications for related supply chains, given the areas of increased production are typically remote from the major logistics hubs. The forecast growth compounded by the distance equation will bring about unique challenges, in which Toowoomba will continue to be involved as a major nodal hub.

Also of note is the new consideration of an inland highway to improve resilience in times of natural disasters, particularly flood events. This 'Queensland Freight Spine' would ensure freight flows to and from north and north-west Queensland to southern locations, concentrating in the Darling Downs/Maranoa for the primary hub/nodal activity. (Refer Report 3 of this project, 'A focus on Queensland's Inland Highway'.

Two other significant transport infrastructure developments located in the region have been reported, at a cost of more than $11b including[9]:

- Inland Rail - from Melbourne to Brisbane via Toowoomba and potentially linking to the Port of Brisbane
- Brisbane West Wellcamp Airport, located 17 km from CBD Toowoomba.

A further proposed development of relevance is the Charlton Wellcamp Enterprise Area (CWEA), located 13 km west of Toowoomba at the junction of the Warrego, New England and Gore Highways, providing additional industrial land in the region.

The eastern boundary of the CWEA site is the corridor for the TSRC and the proposed Inland Rail. Within the northern end of this area, Freight Terminals Trust is proposing to develop a major intermodal freight centre near the junction of the Warrego Highway and TSRC, and the Inland Rail and Western Rail lines[10].

9 http://www.tsbe.com.au/news/media-releases/view/308/toowoomba-epicentre-of-infrastructure-with-current-and-future-developments-totalling-11-billion/media-releases

10 http://www.toowoombarc.qld.gov.au/business-support/projects-and-strategies/charlton-wellcamp-project/1433-charlton-wellcamp-enterprise-area

This demonstrates that the TSRC is a necessary and critical improvement in the national and state road transport network. It also highlights why the QTLC recognises the importance of identifying the benefits of the TSRC for supply chains using the network.

For the potential opportunities of the TSRC to become realised benefits, the design and the connecting infrastructure will need to meet supply chain requirements now and in the future.

As Toowoomba continues to develop, its role as a hub for key national freight routes will place additional pressure on the existing crossing, highlighting the need for a second crossing.

In early 2014, the Commonwealth and Queensland Governments committed a combined $1.6b funding for the TSRC. Since then, Projects Queensland has embarked on a two-stage competitive procurement process to engage a proponent to construct the TSRC. While a reference design was developed, prospective proponents will define specifications and scope for the project, which will be considered as part of the procurement process.

While this approach is likely to promote design innovation, it is important that the long-heralded TSRC supports industries, supply chains and freight movements both now and in the future.

It is therefore imperative to understand supply chains in Queensland and their drivers of change, as well as policy and infrastructure requirements to support future growth. It is also important to identify what supply chains will benefit from the TSRC infrastructure over time, how will these benefits accrue, and what else is required to enable productivity growth.

3 Scope and objectives

The QTLC has produced three reports focusing on Queensland supply chains, this document being the second of those providing:

A focus on the TSRC - an examination of the supply chain benefits, freight efficiency and broader economic opportunities provided by the TSRC.

3.1 Overall project objectives

The overall project, comprising the three primary reports, 11 Supply Chain Perspectives and an analysis of the related legislative and policy, has the objective of:

Better understanding supply chains in Queensland, the drivers of change as well as the policy and infrastructure requirements to support future growth.

In detail the QTLC's objectives are to:

- develop a clear view on supply chains that underpin the Queensland economy and what will drive supply chain change into the future
- define the infrastructure required - current, proposed and not yet identified - to enable the efficient, productive and safe flow of goods; and establish how the resultant benefits will accrue, and in what form
- identify policy and governance settings that are required to allow for success in each supply chain category
- identify additional policy, governance and infrastructure requirements to ensure resilience in Queensland's supply chains in times of natural disasters and unplanned crisis
- influence infrastructure design and/or investment by providing broad initial consideration of the economic and productivity benefits that can be leveraged by better optimising existing or committed corridors.

3.2 Project scope

While there was an unprecedented level of investigation and activity across a broad range of supply chains and related areas at the time of conducting this project, this project is focused on:

- the TSRC
- the potential inland road transport route to improve resilience (Queensland's Inland Highway).

3.3 Specific objective - Focus on the TSRC

The overall objective of this component of the project is to:

Examine the supply chain benefits of the TSRC and the potential for productivity improvement given a defined level of access, including enabling access to other strategic freight routes.

Specific objectives are:

- establish how the TSRC contributes to economic growth and provides a community benefit
- examine the proposed TSRC design and identify what supply chains will benefit, and how this will impact in terms of the unit of movement
- identify within these supply chains:
  - the areas of where the freight generation and consumption occurs
  - access and egress to the TSRC
  - what benefits are available for these supply chains
  - how benefits will be realised
- identify what policy frameworks will impact on the realisation of TSRC benefits
- identify additional opportunities to realise or enhance benefits of the TSRC.

4 Methodology

4.1 Overview

Key inputs used to inform the conclusions in this report include:

- the 11 Perspectives of Queensland supply chains
- a QTLC industry forum on the TSRC
- interviews with industry representatives
- TSRC reference design.

The following reference materials were also reviewed and included to support qualitative data, ensuring accuracy and currency of information:

- related policy and governance frameworks reflecting Commonwealth and Queensland Government strategies and objectives
- existing Commonwealth, Queensland Government and industry reports and information in the public domain
- contribution from industry content experts of information not in the public domain.

Initial inputs to the TSRC investigation were based on the preparation and referencing of information relating to the 11 industry/sector specific Supply Chain Perspectives.

These Perspectives provide detail of the movement patterns, freight volumes, vehicle configurations and nodal activity requirements for each industry/sector investigated. Further, they provided a detailed understanding of the structure and drivers of the major Queensland supply chains, including those that operate and/or have nodal/freight hub activity in the Toowoomba/Darling Downs/Maranoa region, and are therefore potential TSRC users.

Based on information gathered in preparing the Perspectives, the QTLC convened an industry forum with a specific focus on the TSRC. Forum participants included operators from the key industry sectors and involvement by Project Queensland and Department of Transport and Main Roads (TMR).

The detailed knowledge and operational expertise from forum participants offered clear and objective views about the TSRC's role in the major Queensland supply chains. The feedback supported the industry/sector information provided in the Perspectives.

A further key input to the methodology was the proposed reference design of the TSRC. Key elements of that reference design include:

- route: TSRC is a 42 km road corridor, running north of Toowoomba from the Warrego Highway, west of the Helidon Spa, to the Gore Highway around 17 km south-west of Toowoomba
- carriage way: mix of two-lane two-ways, two-lanes plus one lane for overtaking, four-lane two-way, with single and two-lane ramps
- curves: crest and sag curves between 4,200 m and 9,730 m, horizontal curves between 656 m and 794 m, dependent on speed and alignment location
- gradient: main alignment maximum of 6.7%, with 5% on other roads
- pavement: design life of 20 years, 95% project reliability, granular pavement instead of high load density, low intervention pavement
- speed: 100 km/h on open sections, reducing to 80 km/h approaching interchanges, off/on interchanges to local roads at local conditions
- design vehicle: Austroads 36.5 m long B-Triple on main alignment, Austroads 26 m long B-Double at interchanges to Mort Street and Hermitage Road, Austroads 19 m long articulated on all other local roads
- vertical clearance: above local roads 5.5 m, over Warrego Highway East 6.1 m, through tunnels 5.3 m
- cost: $1.6 b, funded on an 80:20 basis from Commonwealth and Queensland Governments
- delivery: single availability-based public/private partnership (PPP) contractual arrangement for the design, construction, finance, operation and maintenance for a 25-year life.

The primary purpose of this report is to examine the supply chain benefits of the TSRC and the potential for productivity improvement given a defined level of access, including enabling access to other strategic freight routes.

This report assesses the likelihood and extent of proposed TSRC benefits, including:

- improved road safety performance
- reduced congestion in central Toowoomba
- reduction in travel times
- increased freight efficiency, with corresponding reduction in operating costs

Further, as outlined in section 5.3, the availability-based public/private partnership approach to the TSRC development is such that the final design can be influenced. Therefore, this report also seeks to identify design factors that can be optimised to enable greater benefit now and in future (future proofing).

The appraisal of TSRC objectives and potential benefits was based on information gathered in preparing the Supply Chain Perspectives and the QTLC's industry forum. The findings provided the basis for commentary on the industry/sector specific benefits and issues related to development of the TSRC (Section 7).

The findings also provided the basis for a detailed analysis of the access, egress and network compatibility issues related to the TSRC (Section 8).

4.2 Appraisal methodology

A desktop approach was used for the TSRC appraisal and supported by operator input at the QTLC industry forum. This approach is recognised as producing indicative, not necessarily authoritative outcomes. All data/information sources are credible and gross-balancing, and/or expert input has been used further to confirm the veracity of information.

Based on the current TSRC design, objectives and potential benefits, the appraisal added to the body of work already undertaken, further supporting the objective of delivering this critical piece of infrastructure in the most productive form possible.

By integrating the objectives and benefits nominated for the TSRC with QTLC's objective, this report presents outcomes for the application of a logical appraisal framework comprised of three levels:

Level 1: Appraising the importance of TSRC. This includes identifying and discussing relevant issues, which are then included in subsequent stages of the appraisal (including the design, nominated objectives and benefits, and the implied, but not specified, benefit of reducing total freight movements).

Level 2: Identifying the potential for productivity improvement. As per the QTLC objective, this relates to a defined level of access, for which the TSRC reference design has been used.

At this appraisal level:

- the nominated TSRC objectives and benefits are quantified for the 11 industries/sectors for which the Supply Chain Perspectives have been prepared
- specific design issues related to individual industry/sectors are identified and discussed.

Level 3: The final appraisal level uses the 11 industries/sectors for which the Supply Chain Perspectives have been prepared to identify:

- opportunities that will be provided by altering the TSRC design
- access to other strategic freight routes enabled by the TSRC, including those issues identified during the industry forum.

While this appraisal framework provides an analysis of the proposed TSRC design and nominated published benefits according to various sectors, a further supply chain assessment was undertaken to assess the impact of nodal activity (origin, transformation and destination) and access to the TSRC, with a view to identifying opportunities to improve productivity.

The supply chain network diagrams, included as Appendix B, show the network of activity considered for each sector, and clearly demonstrate the complexity of some the supply chains – an issue which has a bearing on their ability to gain the potential benefits offered by the TSRC.

The whole-of-supply chain approach confirms the base level principles of the TSRC design and has identified and allowed for benefits not captured in reference material to be quantified.

4.3 Report structure

With the background and summary information provided in the preceding sections, the balance of this report provides:

- summary detail of the TSRC (Section 5)
- outcomes of the TSRC-focused industry forum, convened to obtain industry input to this project (Section 6)
- an appraisal of the potential benefits and objectives of the TSRC (Section 7)
- forecast of expected TSRC movements and assessment of heavy vehicle access to and from the TSRC (Section 8)
- detail of historical safety performance of the existing range crossing (Section 9)
- conclusions drawn from the detailed investigations (Section 10)
- appendices with supporting detail, including:
  - Appendix A: TSRC reference design
  - Appendix B: Supply chain network diagrams, demonstrating the relative complexity of various supply chains that may access the TSRC.

5 Toowoomba second range crossing (TSRC)

5.1 Overview

The TSRC, as depicted in Figure 1, is a 42 km road corridor running north of Toowoomba from the Warrego Highway, west of Helidon Spa, to the Gore Highway around 17 km south-west of Toowoomba.

The TSRC will provide commercial vehicles with an alternative crossing of the Great Dividing Range, which will potentially improve productivity and driver safety, relieve pressure on Toowoomba's roads and enhance liveability for the city's residents.

The Commonwealth and Queensland Governments have committed funding in excess of $1.6b to the project, with costs on an 80:20 basis. The TSRC is expected to be operational from mid to late 2018.[11]

11 Toowoomba Second Range Crossing Project Fact Sheet, Australian and Queensland Governments, June 2014

Figure 1: TSRC route

Source: TSR fact sheet http://www.treasury.qld.gov.au/projects-queensland/projects/toowoomba-range-crossing/tsrc-fact-sheet.pdf

5.2 Freight generators

There are approximately 3,500 truck movements across the range each day.

Figure 2 provides a breakdown of the industries/sectors that generate movements, and which will potentially benefit from the TSRC.

5.3 TSRC design

The process to deliver the TSRC involves a single availability-based public/private partnership (PPP), with the successful proponent to design and construct, and then operate and manage the TSRC for 25 years following successful commissioning.

The proponent ultimately selected to design, construct and operate the TSRC is expected to refine the reference design in line with achieving prescribed TSRC objectives and benefits, this being the 'availability-based' component of the PPP.

It should be noted that:

- the TSRC reference design has been the basis for investigations in this project
- there is opportunity to influence the ultimate design, assuming a case can be made for alterations/ enhancements to the reference design.

The TSRC reference design (see Figure 3) includes[12]:

- four-lane dual carriageway from Warrego Highway East (Helidon) to Mort Street, including twin two-lane tunnels
- three-lane carriageway - Mort Street to Charlton (two eastbound)
- two-lane carriageway - Charlton (Warrego Highway West) to Gore Highway
- grade-separated intersections at Warrego Highway East and Mort Street
- at-grade intersections at Warrego Highway West, Cecil Plains Road and Gore Highway.

12 TSRC – Business Case Development Stage Draft Design Standards, Aurecon November 2012

Figure 2: Daily range movements - number by sector

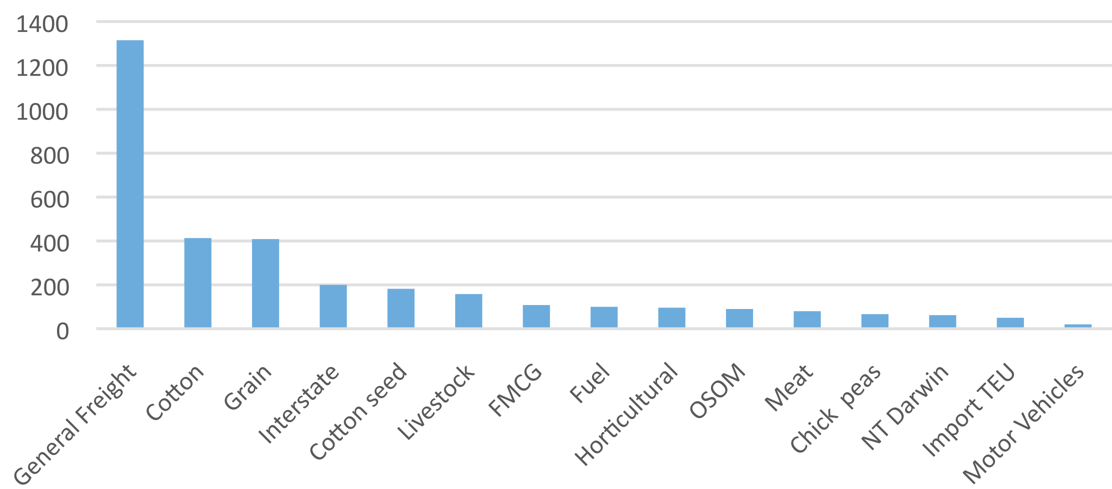
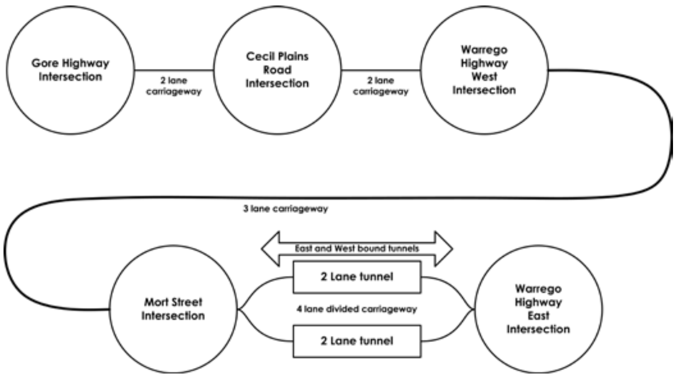


Figure 3: TSRC design overview



The reference design also nominates:

- Austroads 36.5 m B-Triple as the reference vehicle for roadway design
- reference design and tunnel dimensions (source diagrams displaying the dimensions of the tunnels and an easier to read representation are included in Appendix A)
- maximum grade: 6.5%, compared with 10%, with tight horizontal bends, on the current crossing.

It is understood that the tunnels in the reference design are not specified to allow the movement of bulk loads of dangerous goods, including fuel.

Other relevant elements of the TSRC reference design relate to the vehicle configurations for the various interchanges and intersections [13], being:

- Austroads 36.5 m B-Triple for the main TSRC alignment and the Warrego Highway East interchange, the signalised Warrego Highway West intersection, and the intersections at Cecil Plains Rd and the Gore Highway
- Austroads 26 m B-Double for Hermitage Road and Mort Street, including the Mort Street interchange
- Austroads 19.0 m articulated semi-trailer for all other local roads.

13 Toowoomba Second Range Crossing – Business Case Development Stage Draft Design Standards, Aurecon November 2012

5.4 TSRC objectives

The nominated TSRC objectives[14] relevant to this supply-chain-focused investigation are to:

- address a recognised constraint in the National Land Transport Network
- deliver greater benefits for road users and reduce the number of heavy vehicles and through-traffic using urban arterial roads in central Toowoomba
- improve road safety on the network
- improve community amenity, safety and functionality
- improve transport capacity over the range.

5.5 TSRC benefits

The relevant benefits nominated for the TSRC [15] are to:

- reduce travel time (by up to 40 minutes) and provide greater travel time reliability
- accommodate regional growth and increase productivity in the Toowoomba region
- redirect almost 80% of heavy and super heavy commercial vehicles away from the existing range crossing
- create a safer and less congested route than the existing range crossing
- improve freight efficiency and reduce vehicle operating costs, with TSRC documentation citing ‘commercial vehicle operating costs will be reduced by approximately 25%’.

The above potential benefits will be used as the basis of the appraisal framework in section 7.

14 http://www.treasury.qld.gov.au/projects-queensland/projects/toowoomba-range-crossing/tsrc-industry-briefing-june-2014.pdf
15 Toowoomba Second Range Crossing Project Fact Sheet, Australian and Queensland Governments, June 2014

6 Industry forum

The QTLC convened an industry forum to gain industry input and feedback regarding the likely benefits of the TSRC and the factors that would influence the realisation of the benefits. The forum was attended by industry representatives and identified a series of relevant issues and concerns. While most of these are captured in the appraisal and discussed later in this report, a summary of issues discussed is included here.

✪ Reference vehicle

Specification of mass/length combinations/characteristics using the Performance-Based Standards (PBS) framework rather than B-Double/B-Triple terminology will allow for future innovation within the national standard. A PBS Level 3 is suggested.

A related point is the potential to move the Type-1 road train eastern access boundary beyond Toowoomba. The points made are that this option:

- is currently constrained by the range
- uses similar road design characteristics to 36.5 m B-Triple, as it is the nominated TSRC vehicle reference design.

Any reduction in vehicle movement numbers for a given freight task, such as higher productivity vehicles, will:

- have a large impact on road safety, recognising the high cost per incident and community benefit
- improve environmental impact by reducing fuel burn and resulting emissions.

✪ Future-proofing

The need to future-proof the TSRC is seen as critical, particularly for viaducts, bridges and flyovers.

This is critical for cotton, grain and meat exports, where vehicle gross mass requirements are being affected by export supply chain requirements for 'heavier' 40-foot containers. International shipping containers have a rated maximum carrying capacity, and export supply chains seek to maximise container loading to utilise this maximum carrying capacity.

In instances where the road infrastructure network is not designed to allow for maximum loads, these containers are instead transported at a lesser weight. This is a significant impediment to achieving higher levels of productivity in global supply chains.

✪ Reduced cycle times

Potential reduced travel times resulting from the TSRC may allow decreased trip cycle times for some supply chains, from three round trips per day to four in some cases. If achievable, this will allow for a large improvement in shift scheduling/regimes.

Decreasing time in transit for livestock is of particular importance from an animal welfare perspective. Shorter transit times will also likely reduce animal weight loss and decrease the risk of driver fatigue.

✪ Interchange delay

Industry concern was expressed regarding the signalised intersections and the potential for congestion. In particular, it was noted for the Warrego Highway West interchange that the proposed design is not conducive to road trains, and the close distance between lights will be a significant problem for road trains and longer vehicles.

✪ Fuel and dangerous goods

A large proportion of fuel transported over the range is destined for Toowoomba.

Fuel transporters desire to move to A-Double vehicles when able. A major Northern Territory transport company using the existing crossing reported that not all bulk dangerous goods comprise a third of its volume.

The current TSRC reference design specifies that bulk dangerous goods shipments will be excluded from the tunnel.

✪ Network interface

The forum identified that de-coupling yards need to be located on the eastern side of TSRC. A major benefit of this option for the livestock industry would be improved access for B-Triples to their final destination.

Extended B-Triple (or similar) access is one of the most significant potential benefits of the TSRC, with a direct benefit for the Dinmore abattoir, which is the largest in the Southern Hemisphere, processing 3350 head per day. Teys Bros at Beenleigh may also benefit, although to a lesser degree, given access restrictions for high productivity vehicles (HPV) to and through Brisbane south to Logan.

✪ Operating cost reduction

Transport operators suggested the 25% operating cost reduction was unlikely, however some benefit is expected.

✪ Run-off areas

While there are two safety ramps in the reference design, it makes no allowance for vehicle run-off areas in the tunnels, which raises safety concerns and will create significant delays in the case of a breakdown or accident.

7 TSRC benefits by industry/sector

The following section summarises the likely conferred benefits of TSRC by industry, as per the appraisal framework discussed in the Methodology (see Section 4).

In line with the QTLC's objective, this section will assess the extent of nominated benefits for key industries and sectors and further consider additional (not nominated) benefits within the defined level of access, as well as opportunities to improve productivity through design enhancements.

7.1 General comments

In considering the TSRC at a strategic level, there is clear evidence its construction will address a recognised constraint in the National Land Transport Network. However, the full extent of potential benefits is still to be quantified.

A recurring theme at the QTLC TSRC Industry Forum was the importance of a justifiable standard of future-proofing the design to avoid the potential for future constraints. Forum participants indicated there was a need to ensure the TSRC design could accommodate future supply chain trends and the forecast increase in freight related to population and regional growth. They also expressed the view that the reference vehicle for the design should specify mass/length combinations/characteristics using the Performance-Based Standards framework. This would allow for future innovation in the industry within the national standard.

Currently, the 36.5 m B-Triple was nominated as the reference vehicle, which is equivalent to PBS Level 3. Whereas other PBS Level 3 vehicles cater for the international trend to use maximum grossing 40-foot shipping containers to reduce sea freight-related process charges (land transport, stevedoring and carriage), the B-Triple does not.

It is likely the TSRC will deliver its objective of reducing the number of heavy vehicles in urban Toowoomba, to a degree. Vehicles using the TSRC will in turn benefit from avoiding traffic congestion in Toowoomba, which will reduced travel times, provide a safer run on the less congested TSRC, and result in improved efficiency. However, investigations indicate that many heavy vehicles will continue to access the local road network, especially for FMCG, fuel, TEU and general freight movements.

The reference design excludes some categories of bulk dangerous goods, including fuel, from the TSRC tunnels and therefore from the TSRC. This is at odds with the objectives of network and community safety, given that these vehicles would then continue to use the existing range crossing and proceed through central Toowoomba.

The TSRC reference design does not capture the demand for higher container weights. This demand is particularly relevant to cotton, grain and meat and is part of a global trend evolving from the port-centric supply chain concepts. Australia's mass merchants (largest retailers) are also embracing this approach to reduce transport costs and improve payloads.

Primary production represents 42% of potential TSRC movements. While the proportion affected by these emerging container trends is not known, higher mass limit (HML) access via the TSRC would be required to facilitate such activity. This is seen as a significant factor in terms of future-proofing.

While a reduction in the number of heavy vehicle movements was not a nominated published benefit of the TSRC, industry forum participants cited this is a significant benefit, particularly for grain, cotton and meat.

Reduced travel time resulting from the TSRC is likely to allow decreased trip cycle times for some supply chains, increasing from three round-trips per day to four in some cases. If achievable, this will allow for a significant improvement in shift scheduling/regimes.

For livestock, decreasing time in transit is important from an animal welfare perspective. It also means less animal weight wastage and minimises the risk of driver fatigue.

Table 3 summarises the anticipated published benefits of the TSRC by industry, including additional proposed benefits, as well as opportunities for improving productivity. It is important to note that Table 3 uses a continous scale (high versus low) to index anticipated benefits, rather than discrete values, as the manifestation of these benefits can potentially vary, dependent on other supply chain factors.

Where supply chain variables are likely to directly impact the realisation of benefits, this is indicated (▲) with discussion to follow.

The table also identifies opportunities that could be achieved by altering the TSRC design (design enhancements), and access issues related to other strategic freight routes (corridor interface) enabled by the TSRC.

Table 3: Appraisal of TSRC benefits by industry sector

TSRC benefit	Industry/sector: Cotton	FMCG	Fuel	Grain	Horticulture	Livestock & meat	Mine inputs	OSOM	Project & construction	TEU & general freight
Nominated published benefit										
Reduced travel time/greater time reliability	High	High	-	High	High	High	High	High	High	High
Accommodate regional growth	High	Low	-	High	▲	High	High	High	High	High
Increase productivity in Toowoomba region	High	Low	-	High	▲	High	High	High	▲	▲
Redirect HV away from existing range crossing	High	▲	-	High	High	High	High	▲	▲	▲
Safer and less congested route	High	High	-	High	High	High	High	▲	▲	▲
Improved freight efficiency	High	▲	-	High	▲	High	High	High	High	High
Reduction in vehicle operating costs	▲	▲	-	▲	▲	▲	▲	▲	▲	▲
Additional benefits										
Reduction in number of movements	▲	Low	-	▲	▲	▲	▲	▲	▲	▲
Opportunities for productivity improvements										
Design enhancement	▲	▲	▲	▲	▲	▲	-	▲	▲	▲
Corridor interface	▲	▲	-	▲	▲	▲	-	▲	▲	-

High = a benefit is likely to accrue to that industry or sector Low = a benefit is unlikely to accrue to that industry or sector

▲ = supply chain or final design characteristics are likely to directly impact on the extent of benefit that accrues to that industry or sector

7.2 Cotton and cotton seed

➲ Estimated current movements per day: 595, being 17.7% of total heavy vehicle movements.

Benefits

Cotton supply chains are expected to experience a high degree of benefit from the construction of the TSRC, including a reduction in travel cycle times, which in turn will result in improved vehicle utilisation and greater reliability in meeting international shipping schedules. Supply chain cost savings will aid competitiveness in the global cotton market.

Opportunities for productivity improvement

Additional benefit may be realised if future-proofing design enhancements for HML vehicles be catered for in the TSRC design, and access to the east is given for PBS Level 3. This would result in increased productivity and a corresponding reduction in movements as high as 50% from Dalby, as an example.

Reduced travel time/greater travel time reliability	High
Accommodate regional growth	High
Increase productivity in the Toowoomba region	High
Redirect HVs away from existing range crossing	High
Safer and less congested route	High
Improved freight efficiency	High
Reduction in number of movements	▲
Design enhancements	▲
Corridor interface	▲

7.3 Fast-moving consumer goods

➲ Estimated current movements per day: 108, being 3.2% of total heavy vehicle movements.

Reduced travel time/greater travel time reliability	High
Accommodate regional growth	Low
Increase productivity in the Toowoomba region	Low
Redirect HVs away from existing range crossing	▲
Safer and less congested route	High
Improved freight efficiency	▲
Reduction in number of movements	Low
Design enhancements	▲
Corridor interface	▲

Benefits

The vehicle movement profile related to the fast-moving consumer goods (FMCG) sector is directly linked to population, with 108 daily movements. FMCG movements can also be by rigid vehicles in the 4-14t gross vehicle mass (GVM) range; therefore this number of movements will alter in proportion to population growth.

While the number of vehicles using the TSRC to transport FMCG will vary according to the delivery destination and the delivery route (which often incorporates deliveries to multiple customers on a run basis), Toowoomba's large population means that a large proportion of vehicles transporting FMCG may continue to use the existing range to access the local road network.

FMCG supply chains are consumption-based and the availability of the TSRC will not necessarily lead to increased productivity. As such, FMCG vehicle design will remain constant. The profile of vehicles transporting FMCG must be suited to the arrangements at the receiving point, most often in shopping centres/precincts. In these circumstances, operators will not receive any payload benefit from using the TSRC. Tolling of the TSRC would likely decrease current productivity and potentially impact use of the route to move FMCG using current profile vehicles.

FMCG supply chains travelling west past Toowoomba will potentially receive benefits of reduced travel time and improved freight efficiency, with the TSRC accommodating population increases in these western regions. A portion of movements will be directed away from the existing range, with a potential contribution to safety and congestion. A similar portion may not be directed away from the TSRC due to the need to access Toowoomba.

Opportunities to improve productivity

FMCG and general freight will need to access the local road network to travel to delivery locations or nodal points. Access from the TSRC to the local network interchange points and routes will need consideration to ensure that FMCG and general freight movements via the TSRC are able to travel to their destination. Otherwise, the existing route may be the most practical and productive option.

General freight movements are typically made using 26 m B-Doubles, travelling to Toowoomba depots before consolidation, reconfiguration and on forwarding. The preferable point to access the local network for these movements will be the Mort Street exit from the TSRC. Based on available information from TMR, Mort Street only has capability for 26 m B-Doubles.

Consideration should be given to upgrading this intersection to enhance the nominated benefits and network connectivity.

7.4 Fuel

➲ Estimated current movements per day: 100, being 3% of total heavy vehicle movements.

Reduced travel time/greater travel time reliability	-
Accommodate regional growth	-
Increase productivity in the Toowoomba region	-
Redirect HVs away from existing range crossing	-
Safer and less congested route	-
Improved freight efficiency	-
Reduction in number of movements	-
Design enhancements	▲
Corridor interface	-

Benefits

Fuel movements are in the order of 100 return trips each day. Some categories of bulk dangerous goods loads, including fuel, are excluded from the TSRC tunnels, which means they are unable to use the TSRC. Under this assumption, the TSRC is unlikely to benefit fuel movements or deliver TSRC efficiency objectives.

Exclusion of some bulk dangerous goods and fuel from the TSRC tunnels appears to be at odds with the TSRC objectives related to network and community safety, as these vehicles will have no choice but to continue to use the less adequate existing range crossing, and proceed through central Toowoomba.

Given that fuel is a population-based commodity, the destination for many fuel movements will be retail outlets within Toowoomba. Operators delivering to these destinations will likely continue to use the existing crossing, even if fuel and dangerous goods were able to be transported through tunnels on the TSRC.

Opportunities for productivity improvement

If the tunnel design allowed for the movement of fuel and other dangerous goods, there would likely be safety benefits and reduced congestion in Toowoomba, with vehicles carrying fuel destined for areas beyond the urban centre redirected from the existing crossing. Travel time would also reduce, improving freight efficiency.

7.5 Grain

➲ Estimated current movements per day: 476, being 14.2% of total heavy vehicle movements.

Reduced travel time/greater travel time reliability	High
Accommodate regional growth	High
Increase productivity in the Toowoomba region	High
Redirect HVs away from existing range crossing	High
Safer and less congested route	High
Improved freight efficiency	High
Reduction in number of movements	▲
Design enhancements	▲
Corridor interface	▲

Benefits

Grain supply chains are expected to experience a high degree of benefit from the construction of the TSRC.

Grain movements between the Darling Downs/Maranoa area are already experiencing benefits of A-Double configurations transporting containers to/from the Port of Brisbane, gaining payload efficiency and reducing the overall number of movements. The combined benefit of this practice and the introduction of the TSRC has the potential to increase volumes of containerised grain from Northern New South Wales, as far as Moree, for export out of Brisbane. This increase is being driven through constraints in southern supply chains. With daily movements of 96 grain TEU, 108 bulk grain and 33 TEU for chick peas for these supply chains, this could represent a significant productivity gain.

For grain consolidators and TEU transporters based within an hour's drive west of the TSRC, the productivity gain is significant, as the reduced cycle time benefits alone will result in a 25% gain in productivity from reduced trip times.

Opportunities for productivity Improvement

As identified previously, the TSRC reference design does not capture the supply chain trend towards higher container weights.

Additional benefit can be achieved should future-proofing design enhancements for HML vehicles be catered for in the TSRC design and access to the east be given for PBS Level 3. This would likely result in increased productivity and a corresponding reduction in movements.

Primary production represents 42% of potential TSRC movements. While the proportion of primary produce likely to be affected by these emerging container trends remains unclear, higher mass limit (HML) access via the TSRC would be required to facilitate such activity. This is seen as a significant factor in terms of future-proofing.

7.6 Horticulture

➲ Estimated current movements per day: 96, being 2.9% of total heavy vehicle movements.

Reduced travel time/greater travel time reliability	High
Accommodate regional growth	▲
Increase productivity in the Toowoomba region	▲
Redirect HVs away from existing range crossing	High
Safer and less congested route	High
Improved freight efficiency	▲
Reduction in number of movements	▲
Design enhancements	▲
Corridor interface	▲

Benefits

Export-focused horticultural supply chains are expected to experience a high degree of benefit from the TSRC, however benefits vary for domestic horticultural supply chains.

The horticulture sector is comprised of multiple products, of which the varying care requirements translate into numerous individual supply chains.

Irrespective of the specific supply chain, the vast majority of domestic horticultural product is destined for major retailer distribution centres near major cities, or central markets – in this case, mainly Rocklea in Brisbane.

As with FMCG, the characteristics of the destination for domestic horticulture products dictates the suitable vehicle profile (standard rigid and articulated vehicles and B-Doubles). This will not alter with the TSRC and, consequently, there will likely be little benefit associated with increased productivity or a reduction in the number of movements.

There are currently investigations in the Cecil Plains/Dalby area to use the desalinated water from CSG production to create a horticulture growing area, with similar potential for the Lockyer Valley. The strategic direction of the Queensland Government and Commonwealth Government also has the potential to significantly increase horticultural activity in areas that would access Toowoomba as a hub.

Despite this growth potential, the practices in these areas are most likely to be intensive broad acre horticulture targeted at off-shore markets. This export focus is supported by findings of the Lockyer Valley Regional Food Sector Strategy, which identifies that the domestic market is fully or oversupplied with produce. Access to export hubs (airports and ports) is critical for this future growth.

Opportunities to improve productivity

Additional benefit may arise if the TSRC design is enhanced to cater for HML vehicles, and access to the east is given for PBS Level 3. These changes will likely result in increased productivity and a corresponding reduction in movements.

7.7 Livestock and meat

➲ Meat - Estimated current 20-foot TEU movements per day: 80, being 2.4% of total heavy vehicle movements.

➲ Livestock - Estimated current movements per day: 158, being 4.7% of total heavy vehicle movements

Reduced travel time/greater travel time reliability	High
Accommodate regional growth	High
Increase productivity in the Toowoomba region	High
Redirect HVs away from existing range crossing	High
Safer and less congested route	High
Improved freight efficiency	High
Reduction in number of movements	▲
Design enhancements	▲
Corridor interface	▲

Benefits

Domestic livestock and export meat supply chains are expected to experience a high degree of benefit from the construction of the TSRC. This would initially be through reduced cycle time, and reduced fatigue for long- haul drivers, as they will be able to avoid the route through Toowoomba.

The ability for B-Triple movement on the TSRC provides a significant potential benefit for the estimated 158 daily livestock movements travelling to abattoirs in the south eastern area, however this benefit will not be fully realised until access is expanded.

Two B-Triples would replace three B-Double movements, resulting in an estimated 30% productivity gain, depending on vehicle design capacity and livestock profile. The proposed tunnel height will accommodate the current 4.6 m trailer heights, and subject to performance standards and access east and west of the TSRC, could achieve 5 m. This is important in future-proofing, as the forum identified that an increase in trailer heights leads to enhanced productivity.

The Warrego Highway Upgrade Strategy proposes a highway upgrade from Dinmore to Blacksoil, which should allow B-Triple access to Dinmore, the location of the largest volume abattoir in the Southern Hemisphere.

Until access is expanded, decoupling facilities east of the TSRC will need to be provided to achieve any productivity benefits derived from using B-Triple configurations to transport livestock.

Opportunities for productivity improvement

Additional benefit is possible if future-proofing design enhancements for HML vehicles are included in the TSRC design and access to the east is given for PBS Level 3. This will result in increased productivity and a corresponding reduction in movements, especially for the export meat movements. International markets want to see available TEU payload maximised to ensure maximum efficiency across the global supply chain.

Using A-Double with HML combinations to move multiple containers of export meat reduces single TEU movement numbers by 50%. With 80 daily movements, this could represent a significant productivity gain for these supply chains.

Indications are that vehicle width of 2.6 m will become common, and perhaps standard, in future. Current Australian Standards nominate a 2.5 m maximum width, with an allowance for protrusions such as mirrors, lights and to a lesser extent, restraining devices to exceed 2.5 m. The NHVR PBS assessment criteria has the ability to allow vehicles at 2.6 m, although this does not necessarily grant access, which is at the discretion of the road manager. The benefits for wider vehicles include improved safety and stability due to the simple dynamics of a wider track, and the alignment with global - particularly European - standards, allowing use of international standard axle componentry.

High load height and high mass vehicles, such as livestock trailers, have the most to gain from a 2.6 m width as it reduces the centre of gravity (stability), aids livestock welfare and caters for larger livestock. In terms of future-proofing, this factor should be considered in the TSRC design.

7.8 Mine inputs

➲ The number of mine input movements is included in general freight and OSOM.

Reduced travel time/greater travel time reliability	High
Accommodate regional growth	High
Increase productivity in the Toowoomba region	High
Redirect HVs away from existing range crossing	High
Safer and less congested route	High
Improved freight efficiency	High
Reduction in number of movements	▲
Design enhancements	-
Corridor interface	-

Benefits

Mine input supply chains are expected to experience a high degree of benefit from the construction of the TSRC. All movements would likely pass through the TSRC and most would not stop at Toowoomba. The reduced congestion and delays, reduced cycle times and improved road safety performance all aid efficiency.

Opportunities for productivity improvement

Additional benefit is likely if future-proofing design enhancements for HML vehicles are included in the TSRC design, and access to the east is given for PBS Level 3. This would result in increased productivity and a corresponding reduction in movements.

7.9 Over-size over-mass (OSOM)

➲ Estimated current movements per day: 90, being 2.7% of total heavy vehicle movements.

Reduced travel time/greater travel time reliability	High
Accommodate regional growth	High
Increase productivity in the Toowoomba region	High
Redirect HVs away from existing range crossing	▲
Safer and less congested route	▲
Improved freight efficiency	High
Reduction in number of movements	▲
Design enhancements	▲
Corridor interface	▲

Benefits

OSOM is in the order of 90 movements per day. This includes project and construction-related OSOM movements.

Based on the analysis and the tunnel dimensions in the reference design, approximately 80% of OSOM movements will be able to use the TSRC. The balance of OSOM movements (higher and/or wider loads), will likely continue using the current range crossing or a route via Goondiwindi, which is current practice for some OSOM.

OSOM supply chains will likely realise other benefits from the TSRC such as reduced travel times, which in turn leads to increased freight efficiency.

Opportunities for productivity improvement

The TSRC reference design will accommodate 80% of current over height OSOM movements. Table 4 profiles the height of OSOM movements to and from the Darling Downs/Maranoa area for 2012/13. Taking load width into account, almost 90% of these loads would be accommodated by a 5.6 m tunnel clearance.

Table 4: OSOM movements to/from Darling Downs/ Maranoa

HEIGHT	Movements	Percentage of Total
<5.3	9,915	80.97%
5.3-5.6m	1,040	8.49%
5.6-6m	1,260	10.29%
6-6.3m	30	0.24%
>6.3m	0	0.00%

Additional benefit is available if future-proofing design enhancements for increased height are included in the TSRC design. This will result in an increase of 80% to 90% of all movements able to use the TSRC. Access to the east is not an issue, as OSOM travels under individual permit. In comparison to the current requirement to travel OSOM via Goondiwindi, the TSRC offers the potential for reduced travel times and duration of movements, which will significantly improve productivity.

7.10 Project and construction

➲ The number of project and construction movements are included in general freight and OSOM.

Reduced travel time/greater travel time reliability	High
Accommodate regional growth	High
Increase productivity in the Toowoomba region	High
Redirect HVs away from existing range crossing	High
Safer and less congested route	▲
Improved freight efficiency	High
Reduction in number of movements	▲
Design enhancements	▲
Corridor interface	▲

Benefit

Project and construction supply chains will likely realise the general TSRC benefits associated with reduced travel times, in turn leading to improved freight efficiency.

The potential for HPVs will also likely have significant benefits for large engineering and major project and construction cargo used in large-scale developments such as resource developments, infrastructure and agricultural expansions, most of which is destined for regional areas.

This supply chain very often starts at the Port of Brisbane or industrial estates. In these instances, the potential use of HPVs on the route to the TSRC will be constrained by heavy vehicle access arrangements.

Opportunities for productivity improvement

Access east of the TSRC will govern the extent of productivity gain available. TEU, fuel, OSOM, and general freight movements are all a component of projects and construction, and the opportunities for productivity improvement for those supply chains will flow on to project and construction.

7.11 TEU and general freight

➲ Estimated current movements per day: 1,365, being 40.8% of total heavy vehicle movements, including non-OSOM mine inputs and project and construction

Reduced travel time/greater travel time reliability	High
Accommodate regional growth	High
Increase productivity in the Toowoomba region	▲
Redirect HVs away from existing range crossing	▲
Safer and less congested route	▲
Improved freight efficiency	High
Reduction in number of movements	▲
Design enhancements	▲
Corridor interface	-

Benefits

TEU and general freight supply chains will realise TSRC benefits relating to reduced travel times, which in turn will lead to improved freight efficiency.

For import TEU movements and general freight, the location of nodal activity, such as transport depots and container processors, are often in, or on the fringe of major population areas. Access to, and capability at, the nodal points limits the use of HPVs, and it likely this profile will not change to any great extent.

The capability of the 'local' network access points and routes will need to be considered to ensure FMCG and general freight movements via the TSRC are able to travel to their destination. Otherwise, the existing route may be the most practical option. This issue was highlighted by a freight operator at the industry forum. The freight operator moves over 750 general freight movements per week from South East Queensland to various destinations in 26 m B-Doubles using the existing range crossing. These movements typically travel to the Toowoomba depots before consolidation, reconfiguration and on-forwarding. The preferable point to access the local network for these movements would be the Mort Street exit from the TSRC. Based on available information from TMR and the TSRC reference design, Mort Street, including the TSRC interchange, only has capability for 26m B-Doubles. Consequently, the operator will continue to use the existing range crossing until the Mort Street interchange can accommodate 26 m B-Doubles.

Opportunities for productivity Improvement

Additional benefit is possible if future-proofing design enhancements for HML vehicles is included in the TSRC design, and access to the connecting network east is given for PBS Level 3. This will result in increased productivity between 25% and 30%, with a corresponding reduction in movements. A proportion of TEU and general freight movements would still need to access local road networks in the Toowoomba Regional area, which will be governed by the access from Mort Street, and influenced by toll charges.

7.12 Summary

➲ Reduced travel time/greater travel time reliability

While the nominated 40-minute travel time reduction cannot be confirmed, operators recognise that any reduction in travel time, or increase in travel time reliability, would be a significant benefit for loads accessing the TSRC.

Concerns were expressed at the industry forum regarding the potential for congestion at the proposed signalised intersections/interchanges, with the potential to erode any travel time and reliability benefits.

It is expected that reduced travel time will provide benefits in cycle times in some cases, potentially allowing an additional trip cycle each day. The higher degree of certainty in trip times, coupled with the time reduction, is likely to provide a large improvement in shift scheduling/regimes and therefore improved shift efficiency. Added to that – although subjective – operators recognise that the less stressful route and reduced trip time will be of genuine benefit in terms of driver fatigue.

➲ Accommodate regional growth

From a supply chain perspective, the TSRC will enable vehicle efficiency, both in travel time and increased load mass where possible. It will also enable a greater degree of certainty in performance for movements that cross the range – on a potentially safer route with less impact on social amenity.

In that context, the forecast substantial growth in the region will likely be better accommodated by the introduction of the TSRC, however, the TSRC reference design does not incorporate features that will future-proof the corridor in terms of accommodating expected developments in supply chain methods.

Most notable is the trend towards 40-foot shipping containers, which will require HML capability to maximise the potential for multiple container A-Double (or like) movements from the region to the Port of Brisbane. While the level of potential uptake is unknown, there is a possibility it will be required for cotton, grain and meat, which represents more than 42% of current heavy vehicle movements using the existing range crossing. This consideration is seen as a critical future-proofing requirement.

A further issue relates to the TSRC tunnels, specifically height. OSOM movements to service the Darling Downs/Maranoa region, and the more distant regional areas on the corridors that hub via Toowoomba, will be better accommodated by an increase in the tunnel height.

An increase to accommodate 5.6 m high loads will improve the proportion of OSOM loads able to travel on the TSRC to >90%, as opposed to the <80% catered for in the reference design; noting that the expected industry growth is likely to increase OSOM movements.

➲ Increase productivity in the Toowoomba region

As previously stated, the vehicle efficiency and greater degree of certainty in the transport task provided by the TSRC will likely lead to improve productivity in the region, using a safer route with less impact on social amenity.

The issue of future-proofing the TSRC design to cater for HML access and OSOM movements will also be beneficial to productivity in the Toowoomba region.

The removal of freight movements from the ‘local’ road network (those not destined for nodal points in the area or that will access those nodal points from the TSRC) will be beneficial to traffic flows in Toowoomba. This should provide productivity benefits to vehicle movements destined for local nodal points as a result of reduced congestion in central Toowoomba.

Lawrence Consulting has estimated the benefit of the TSRC for industry productivity for existing local businesses in Toowoomba, and for adjacent industrial developments, notably the Charlton Wellcamp Industrial Area[16] (prepared for Toowoomba and Surat Basin Enterprise (TSBE).

16 Economic Impact of Toowoomba Second Range Crossing – Lawrence Consulting March 2013

The economic benefit estimates provided by Lawrence Consulting, expressed as high and low scenarios to baseline gross regional product (GRP) (2011/12) for Toowoomba, are:

- industry productivity: low 3.34% high 7.30%
- existing local business in Toowoomba: low 2.3% high 6.7%
- Charlton Wellcamp Industrial Estate: low 10.76% high 13.96%.

➲ Heavy vehicles redirected away from the existing range crossing

The eventual volume of movements likely to be directed away from the existing range crossing will be impacted by the application and value of the toll charges applied.

The TSRC reference design excludes some categories of bulk dangerous goods loads. As such, 100 fuel consignments a day and an estimated 50-75 dangerous goods movements a day (based on 30% of long-haul distribution) will need to continue to use the existing crossing.

In addition, based on the reference design for the TSRC tunnels, >30 OSOM movements a day will continue to use the current road or transit via the Cunningham Highway. This would likely be reduced to <15 if the tunnels were able to accommodate a 5.6 m high load height.

The route distribution profile for FMCG requirements is such that the sequence of deliveries (route distribution) may result in those vehicles using the existing crossing for either the inward or outbound leg of the route.

A potentially more significant issue is the limitation of TSRC access/egress to enable movements destined for local nodal points. In one example, the preferable point to access the local network for major interstate transport will be the Mort Street exit from the TSRC. The vehicle configuration used is 26 m B-Double, however, Mort Street - including the TSRC interchange - is proposed as 26 m B-Doubles.

The delivery of FMCG goods to retail and other commercial operations within Toowoomba is likely to result in a large proportion of these vehicles continuing to use the existing range crossing to access local roads. This includes fuel deliveries destined for retail outlets.

➲ Safer and less congested route

Operators expressed concern regarding the signalised TSRC intersections, and therefore the potential for congestion. Also of concern was analysis of where new bottlenecks will/may appear when the current Toowoomba bottleneck has been removed.

In regard to the Warrego Highway west interchange, operators suggested the interchange design is not conducive to road trains and that the close distance between lights will be a problem.

The exclusion of fuel and other bulk dangerous goods movements from the TSRC is noted. These categories will continue on the existing crossing and access Toowoomba as per current practice. The existing crossing is widely recognised as being inadequate for this task, and the decision to exclude fuel and other bulk dangerous goods would appear contrary to broader safety and amenity objectives.

➲ Reduction in vehicle operating costs

Based on operator feedback, the nominated 25% of operating cost savings is not seen as realistic. However, the operators do expect:

- a reduction in fuel consumption, due the reduction in grades and heavy suburban traffic, and the elimination of traffic signals.
- reduced maintenance costs on the engine, drive train, running gear and brakes, also due to the improved grades, bypassing heavy suburban traffic, and the elimination of traffic signals.
- an overall improvement in asset utilisation due to increased productivity benefits.
- improved freight efficiency.

As identified, the TSRC is expected to provide travel time, planning and operating cost benefits that will improve freight efficiency across all the industries/sectors able to access the TSRC. Also identified is the need to future-proof the route by providing capability for HML and potential 2.6 m wide vehicles. This is seen as critically important for future efficiency.

While not seen as problematic in itself, the use of a defined reference vehicle - the 36.5 m B-Triple - as a reference vehicle is potentially limiting. Industry input suggests that a series of characteristics, rather than a specific vehicle, would provide for greater future innovation and benefits.

The TSRC design to accommodate 36.5 m B-Triples or vehicles with similar characteristics is generally acknowledged as beneficial. However, this is only beneficial for movements on the TSRC, after which point vehicles will have to be reconfigured to access the South East Queensland networks, or the reverse process for movements from South East Queensland. This will require appropriate staging areas.

➲ Reduction in number of movements

The potential to reduce movements through the uptake of a higher productivity vehicle combination was not initially nominated as a benefit for the TSRC, but is a measure that will indicate improved productivity and network performance.

The use of A-Doubles to move multiple grain containers is a current example of this practice.

Based on operator input, livestock transport is likely to adopt B-Triple operation for movements to abattoirs in South East Queensland, although this will require reconfiguration at the end of the TSRC for the final movement to the abattoir. The change will likely result in fewer movements on the TSRC, but no change to the balance of the South East Queensland network.

A significant and recurring issue identified during the appraisal analysis relates to access east of the TSRC. The following supply chain assessment specifically examines this access issue and identifies opportunities to resolve this constraint.

8 Supply chain assessment

The previous appraisal analysis sought to examine the proposed TSRC design and identify likely manifestation of the nominated benefits for supply chains that will traverse the TSRC.

Based on these considerations, the assessment of the nominated TSRC benefits and the associated policy implications and/or infrastructure requirements is provided in the following three sections, being:

- TSRC-related movements
- access west of the TSRC
- access east of the TSRC.

8.1 TSRC movements

To identify the potential benefits available for supply chains able to use the TSRC, it is necessary to understand the relationships between the nodal activity and the TSRC. Each supply chain key nodal activity has been identified and captured in each of the Perspectives.

Based on the identified number of daily movements for each supply chain able to use the TSRC, the logic framework shown in Table 5 was applied to identify those supply chains that could use the TSRC and to what extent. Please note the table is not populated, rather it is included for demonstration purposes only.

Table 5: Logic framework

Value Stream	Supply Chain	Toowoomba				
		To	From	Through - no stop	Through - value adding	Through - SC practice
Population Based						
Production System						
Distribution Network						

A number of locations west of the Great Dividing Range are serviced via Toowoomba. Population levels in these areas influence population-based supply chains.

Of the total population in areas that could be serviced via the TSRC, Toowoomba represents 52.7%. The Granite Belt is excluded, as it is most likely to be serviced via the Cunningham Highway route.

Table 6: Regional population

Region	Population	Percentage
Queensland	4,656,803	100%
Darling Downs (West) - Maranoa	45,377	1.00%
Darling Downs - East	42,565	0.90%
Granite Belt	40,373	0.90%
Outback North	35,327	0.80%
Outback South	20,488	0.40%
Toowoomba	160,251	3.40%
Total	**344,381**	**7.40%**

Source: Queensland Regional Profiles http://statistics.oesr.qld.gov.au/qld-regional-profiles, 2013 Projections

The population-based analysis relating to movements 'to, from or through' Toowoomba for these supply chains identifies which supply chains may benefit, the assumptions used and the resulting number of daily movements – a being those that may/will use the TSRC.

Table 7 provides a current estimate of daily range crossing heavy vehicle movements which is around 3,350. Based on the analysis framework, approximately 70% or 2,345 of those movements may use the TSRC, subject to the access required to the west and east of the TSRC. These potential forecast movements via the TSRC will be influenced by access either side of the TSRC.

Table 7: Daily forecast movements

TSRC daily movements forecast	TEU road (annual tonnes)	Bulk road (annual tonnes)	Pallets (annual)	Head/day	Daily movement	Daily return trips
Livestock				6,400	79	158
Meat	142,000				40	80
Cotton	665,000				207	413
Cotton seed	235,500	176,176			91	182
Grain	622,000	923,793			204	409
Chickpeas	207,840				33	67
FMCG			361,801		54	108
Fuel		615 Ml			50	100
OSOM					45	90
Horticultural		187,168			48	96
General freight*					658	1,315
- Import TEU	6,427				25	50
- Mine inputs	*included in General freight*				0	0
- Project construction	*included in General freight*				0	0
- NT Darwin					31	62
- Interstate (excl CG**)					100	200
Motor vehicle carriers					10	20
Total daily initial estimate					1,861	3,350
TMR range crossing traffic flows TMR Census 2012						3,456

Note: Annual values shown to index daily movements.
Note: Should TSRC allow PBS HML combinations, the number of movements will fall corresponding to the productivity gain, until such time as increases in production add additional movements.
* Includes mine inputs, project and constructions, as well as other general freight products.

** Cunningham Highway route

8.2 Access to the west of the TSRC

On the western side of the TSRC, a number of highways emerge and feed into the Warrego Highway East, providing a distributor network to western and Outback Queensland, the Northern Territory and the southern and western states of Australia. The current access regimes are[17]:

✪ Toowoomba

25 m B-Double routes on Drayton Road, James Street, Cohoe Street, the existing range crossing, Bridge Street, West Street, Mort Street, Griffiths Street, Ruthven Street, Chalk Drive

✪ New England Highway North

2 5 m B-Double from Chalk Drive, Ruthven Street, Mort Street, Griffiths Street

✪ New England Highway South

25 m B-Double from Ruthven Street

✪ Hermitage Road/Mort Street interchange

B-Triple (or equivalent) on TSRC to general access to Hermitage Road then 25 m B-Double to Mort Street

✪ Toowoomba Cecil Plains Road interchange

Type 1 road train, includes B-Triple

✪ Warrego Highway West

Type 1 road train, includes B-Triples, from/to McDougall Street, Taylor Street, Tor Street, Anzac Avenue, Pittsworth/ Millmerran Road connecting to the Gore Highway and Carrington Road (Cecil Plains)

Type 1 road train, includes B-Triples through Dalby to Roma, and connections to Moonie Highway, Dalby Kogan Road, Dalby Jandowae Road, Dalby Cecil Plains Road

✪ Gore Highway

Type 1 road train, includes B-Triples, to Goondiwindi and connections to Leichardt, Moonie, Cunningham, Barwon, Carnarvon, Castlereagh Highways and Meandarra Talwood Road, Talwood Boonanga Road and Noondoo Thallon Road

B-Triple access from Goondiwindi to Toowoomba

17 Source: Multi-combination routes and zones in Queensland, TMR 2014; http://www.tmr.qld.gov.au/Business-and-industry/Heavy-vehicles/Multi-combination-vehicles/Maps.aspx

✪ Gore Highway TSRC interchange

B-Triple (or equivalent) on TSRC to Type 1, includes B-Triples on Gore Highway

✪ InterlinkSQ Terminals, Charlton Wellcamp Enterprise Area (CWEA)

Proposed 200 hectare industrial development located north of Warrego Highway West and 1 km west of the TSRC corridor past the Hermitage Road connection, with general access from the Warrego Highway via Stegers Road into Drapers Road

From this, and based on the TSRC reference design of a B-Triple (or equivalent), there is potential misalignment at TSRC, dependent access points including:

- Hermitage Road/Mort Street interchange
- InterlinkSQ Terminals, Charlton Wellcamp Enterprise Area (CWEA).

The Hermitage Road/Mort Street interchange would provide an efficient link to those businesses currently located in the following industrial estates:

- Cranley
- Harlaxton
- Wilsonton
- Torrington
- Harristown and Drayton
- Inner City South
- Inner City North.

The Cranley, Harlaxton and Inner City estates are closer to the Toowoomba CBD, with 25 m B-Double access. Wilsonton and Torrington are further to the west, roughly at a mid-point between the Toowoomba CBD and the proposed TSRC crossing of the Warrego Highway West.

Parts of Wilsonton and Torrington Estates currently have Type 1 road train and B-Triple access. The Harristown and Drayton estates are situated close to the Gore Highway with Type 1 road train and B-Triple access, with 25 m B-Double access on Drayton Road.

The proposed InterlinkSQ Terminal at the 2,000 hectare Charlton Wellcamp Enterprise Area (CWEA), has been proposed as a potential significant future major economic contributor to the region. This terminal will host industry including:

- freight terminals to support current and future rail operations
- logistics operations
- agricultural products precinct

- grain storage
- container processing
- rest stops and truck/trailer parking, and other industrial activities.

The proposed InterlinkSQ Terminal[18], which is 8 km from the Toowoomba airport and 3 km from the Wellcamp Business Park and airport precinct, would generate road freight movements into and out of the precinct.

Further analysis is warranted to establish which InterlinkSQ-based industry sectors and businesses would access the TSRC and in what unit of movement, as well as the number of movements generated and the benefit. As the design currently stands, there is general road access only via Stegers Road.

The Toowoomba Regional Council (TRC) has stated in its Draft Toowoomba Region Sustainable Transport Strategy[19] a desire to regulate heavy vehicle traffic through Toowoomba. This strategy specifically mentions it is likely there will be a need to regulate heavy vehicle movement through central Toowoomba to ensure heavy vehicles use the TSRC.

While the TRC transport strategy may seem at odds with the aforementioned observations relating to TSRC access to north, central, south and west Toowoomba industrial estates, it is critical that complementary strategies are developed to ensure these supply chains are not adversely affected and are afforded every opportunity to gain benefit from the TSRC.

8.3 Access to the east of the TSRC

East of the TSRC is the South East Queensland region, a population-centric region supported by light industrial, industrial, manufacturing, processing, retail, wholesale, commercial, services and leisure activities. South East Queensland incorporates major centres including:

- Ipswich
- Brisbane
- Logan City
- Gold Coast
- Sunshine Coast
- Redland City

The region hosts connections for all main arterials to the north, south and east of the state, including links to major rail intermodal terminals, Queensland's major trading port, the Port of Brisbane, and the Brisbane Domestic and International Airports.

Primary, horticultural production areas are located between the TSRC and South East Queensland, notably the Lockyer Valley and Gatton. These areas produce significant horticultural products for domestic and export purposes.

Access in South East Queensland for heavy vehicles, including multi-combination vehicles, is required to support economic activity involving:

- industrial estates
- processing/value adding facilities, such as abattoirs, flour milling, fabrication and light manufacturing
- logistics hubs and product storage locations, for fuel, FMCG and general freight
- wholesale and retail commercial operations
- business and administrative services
- community services.

The current access regimes east of the TSRC are as follows[20]:

- 25 m B-Double access via Warrego Highway, Ipswich, Logan and Gateway Motorways or via Warrego Highway, Ipswich Motorway, Ipswich, Riawena, Kessels and Mt Gravatt-Capalaba Road, Gateway Motorways; with both routes linking to the Pacific Motorway.
- To access the consumption/generation nodes, the following routes are transited as follows:
  - **Brisbane northern areas**

    26 m B-Doubles across the Gateway Bridge to Hamilton, Eagle Farm, Pinkenba, Nudgee, Hendra, Northgate, Virginia, Zillmere, Brendale, Strathpine, Burpengary, Narangba, Clontarf, Petrie and Lawnton, Morayfield; then north on the Bruce Highway.
  - **Brisbane eastern areas**

    25 m B-Double access to Hemmant, Lytton, Colmslie, Murarrie and the Port of Brisbane precinct, Cleveland and Mount Cotton.
  - **Brisbane southern areas**

    25 m B-Double access to Inala, Richlands, Acacia Ridge, Archerfield, Coopers Plains, Rocklea, Salisbury, Yeerongpilly, Moorooka, Parkinson, Heathwood, Larapinta, and south on Mt Lindsay Highway to Bromelton and Beaudesert.

    25 m B-Double access to Logan, including Heritage Park, Crestmead, Berrinba, Slacks Creek, Loganlea, Beenleigh, Waterford, Staplyton, Yatala, Ormeau, Woongoolba, Pimpama, then onto the Gold Coast via the M1 Freeway.

18 http://www.interlinksq.com.au/index.htm
19 Draft Toowoomba Region Sustainable Transport Strategy, Toowoomba Regional Council, July 2014.

20 While suburbs are referenced, access is to specific locations as approved by TMR

- **Brisbane western areas**

  26 m B-Double access to Seventeen Miles Rocks, Darra and Sumner Park.

- **Brisbane CBD areas**

  General access only.

- **Ipswich areas**

  25 m B-Double access to Ipswich, Bundamba, Oakleigh and Peak Crossing.

- **Toowoomba Range to Ipswich corridor**

  25 m B-Double access to an explosives plant, quarry, livestock yards, grain handling facilities and numerous farms and horticultural post-harvest treatment and logistics hubs, from Helidon through to Plainlands, with access around Ipswich relating to waste transfer, fuel, wholesale and retail, coal and manufacturing and logistics operations.

This data suggests a misalignment between the TSRC reference design vehicle being a B-Triple (or equivalent) and access to key freight areas. From the Perspectives, the areas where supply chains predominately originate or are destined, are:

- Brisbane East, Port of Brisbane and surrounding industrial estates
- Brisbane South to Logan, at logistics hubs, value-adding facilities and industrial estates
- Ipswich areas, at logistics hubs, value adding facilities and industrial estates.

8.4 Summary

To enable the full productivity benefits potentially available through use of the TSRC reference design vehicle, consideration should be given to the following:

➲ Issues: East

- The potential for the Warrego Highway Upgrade Strategy to align to the TSRC reference design and associated objectives so that the TSRC reference design vehicle combination of a B- Triple (or equivalent) can transit in that configuration for the maximum travel distance. This would require:
  - a review and adjustment of the Warrego Highway Upgrade Strategy from the proposed PBS Level 2B under permit, currently proposed to Port of Brisbane only, to align to the B-Triple or equivalent PBS Level 3. The review should reflect this level of access across the end-to-end supply chain.
- Identification of which locations/facilities would require and could accommodate direct B-Triple (or equivalent) access, especially with respect to locations in the Brisbane East, South and Ipswich areas.
- Identification of which locations/facilities would require, but could not accommodate, direct B-Triple (or equivalent) access, especially with respect to locations in the Brisbane East, Brisbane South and Ipswich areas. This would indicate the need or otherwise for a de-coupling yard or yards, located to facilitate the potential productivity gains.
- Should access for B- Triple (or equivalent) not be permitted to the east of the TSRC, then an alternate de-coupling yard will be required at the eastern side of the TSRC at a location suitable for the requirement.

➲ Issues: West

- B-Triple (or equivalent) access is already available to the point of the TSRC interchange at the Warrego West and Gore Highways. Assuming the access arrangements are aligned, these combinations could directly access the TSRC and exit, subject to the outcome of the decision made regarding access to the east of the TSRC.
- Access for other vehicle combinations exiting the TSRC to enter Toowoomba is an area of concern. Should suitable access and egress not be available for these combinations prior to the Warrego West crossing, those supply chains that are population-based value streams, and others that either incur a value-adding transformation or undergo a supply chain practice in Toowoomba, may not use the TSRC and continue to use the existing range crossing.

➲ Heavy Vehicle Action Plan (HVAP)

- The HVAP states that the main supply chains using the Warrego Highway East/West and return are agriculture, mining (resources) and general freight. The HVAP also identifies that the Warrego Highway East to west of Roma, the Mt Lindesay Highway and The Pacific Motorway, are all under consideration in a priority framework for further infrastructure investment over the next 10 years.
- While it is agreed that this infrastructure will require assessment for the use of HPV, the maximum time frame of 10 years may result in a period where benefits from the TSRC investment cannot accrue to the wider economy due the east, south and Ipswich access constraints, as identified above.

➲ Cost of tolls versus benefit

- The ultimate decision around use of the TSRC will be determined according to whether the total cost of using the TSRC is less than the value of benefit being derived, and that other operational advantages are evident. This may include improved road safety performance and enhanced fatigue management outcomes, improved and reduced trip cycle times, increased asset use and an overall reduction in operation costs. That is, the toll cost is lower than the savings and benefits derived.

At the time of writing, the tolling charge was not available, nor was quantification of the cost saving to respective supply chains.

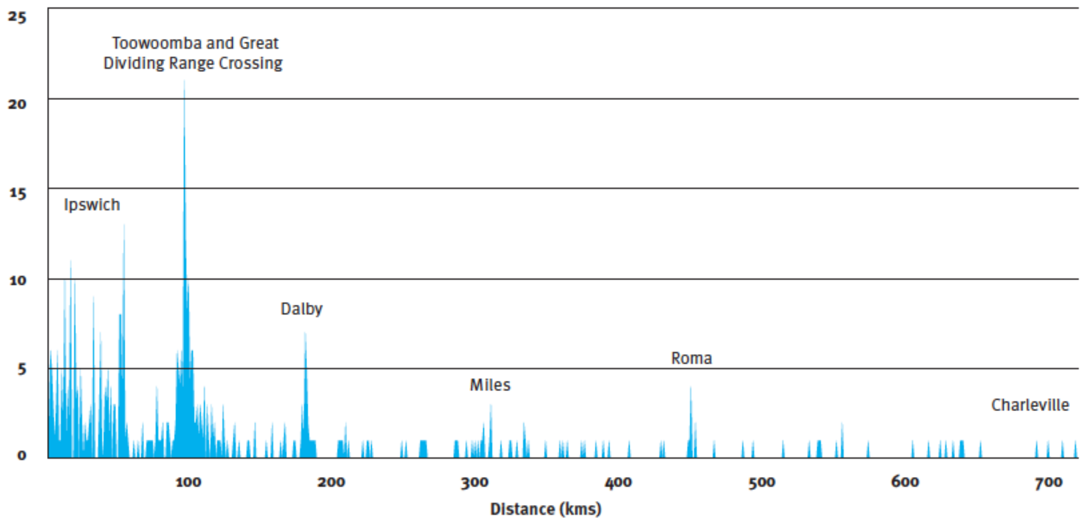
9 Road performance benefits

In addition to the supply chain benefits identified from the TSRC's introduction, other benefits, such as an improvement in road safety and reduced traffic congestion, are likely to also be achieved.

Road safety

In road safety performance, the existing Toowoomba Range crossing has twice the number of incidents compared to other sections of the Warrego Highway. The following graph, from the Warrego Highway Upgrade Strategy, shows the spike in incidents resulting in a fatality or a serious injury at the current range crossing. The graph also highlights the density in the frequency of incidents on the eastern and western approaches to the current crossing.

Figure 4: Warrego Highway fatal and seriously injured crashes (2005-2009)



Source: Warrego Highway Upgrade Strategy 2012, Department of Transport and Main Roads

Table 8 details road safety incident data for the Warrego and Gove Highways with the Warrego rated as a high risk, with 37 deaths between 2005-2009.

Table 8: Road safety statistics – Toowoomba Crossing (2005-2009)

From-to	Type	Length km	Traffic vehicles per day	Casualty crashes 2005-09	Deaths 2005-09	Collective Risk rating Annual average casualty crashes per km
Warrego Hwy						
Cunningham Hwy to Gatton	Dual	55	23,700	404	20	High
Gatton to Helidon	Dual	20	12,600	29	1	High
Helidon to Toowoomba	Dual	16	17,600	63	2	High
Toowoomba to Dalby	Single	74	5,800	94	14	Medium-high
Gore Hwy						
Toowoomba to Yandilla	Single	64	3,100	46	3	Medium

Source: AusRAP How Safe Are Our Roads? Rating Australia's National Network for Risk, Benchmarking the performance of Australia's roads in the Decade of Action, 2011.

In addition to injury and death, BITRE estimates that the average costs of individual road crashes in 2011 was:

- fatality $3,180,598
- serious injury $316,869
- injury $17,511.

Based on the above information, the financial impact of injury and death from crashes on the existing Toowoomba Range crossing (Helidon to Dalby sections) over the five-year period from 2005-09 is in the vicinity of:

- casualty crashes $49.7m
- deaths $50.9m.

As previously noted, the road safety performance of the existing range crossing has deteriorated since 2010. The TSRC is expected to significantly improve this performance, resulting in less road deaths and causalities with an overall reduction in the associated costs.

➲ Congestion

While the TSRC will reduce congestion through Toowoomba, the TSRC, based on reference design, may continue to encounter congestion.

Currently, there are no run-off provisions planned for the TSRC tunnels, which means that should a vehicle breakdown or a safety-related incident occur in the tunnels, the impacted vehicles cannot move out of the through lanes, creating delays. This reference design component should be reviewed to ensure there is no detrimental impact to road safety results, and to minimise the threat of potential congestion. A document review of other tunnel designs in Australia suggests a mixed approach to this design issue.

10 Conclusions

The Queensland Government has a strong focus on helping industry develop integrated end-to-end supply chains. Planning to support these supply chains must go beyond traditional geographic and/or agency boundaries. This has been demonstrated in a number of recent reports regarding Queensland supply chains, in particular our export and agricultural chains [21] [22] [23].

The Queensland Government has correctly identified that not looking beyond those traditional boundaries has constrained planning. This report, commissioned by the QTLC on the TSRC investment/benefits, is a sound case study in taking a new approach.

To provide industry with the highest level of access to existing and new markets, both domestic and export, supply chains must be seamless, ensuring high levels of efficiency. The government's role then, in this context, is to ensure that appropriate infrastructure is in place for these supply chains to access these markets, and that policy frameworks are aligned to ensure that the best return from this infrastructure can occur.

The TSRC crossing in isolation - and without addressing the access issues to the east and west, together with a number of reference design and specification matters - will likely provide a lesser range of benefits than those initially forecast. The nominated benefits likely to be realised are improved road safety and driver fatigue, and travel time reductions, with a partial uptake by industry based on through traffic that does not stop in Toowoomba. This will lead to a corresponding improvement in congestion in central Toowoomba.

The potential range of benefits are greatly increased by taking an end-to-end view, as this report does, and by looking at the access issues to the east and west, and considering reference design enhancements to meet industry requirements.

The benefits would, based on the proposed reference design vehicle (B-Triple or equivalent), include the ability to access key locations to the east of the TSRC in South East Queensland and substantial road transport productivity gains of around 25% to 30%, with a corresponding drop in road movements. The TSRC infrastructure should also be future-proofed in terms of tunnel envelopes (height and width), pavement design and safety within the tunnels for the movement of OSOM and dangerous goods.

21 Strengthening Queensland Supply Chains 2013-2015, Queensland Transport and Logistics Council
22 Queensland Ports Strategy, Department of State Development, Infrastructure and Planning 2014
23 Report No. 54 Rail freight use by the agriculture and livestock industries, Transport, Housing and Local Government Committee June 2014

Access into and out of Toowoomba for the local supply chains should also be addressed to ensure the TSRC benefits are maximised.

Critical for growth

The TSRC is critical for growth. The current range crossing is at capacity and has road safety performance issues. The Warrego Highway and the other highway connections to the west of the TSRC support a significant contribution to the Queensland economy through agricultural and CSG LNG projects, along with current and future mining activities. These networks also provide access to regional Queensland and interstate and Northern Territory freight networks.

Gross Regional Product (GRP) from the resources sector in the Surat Basin in 2011 was $11.1b[24], and is expected to double by 2031. In the same period, the number of heavy vehicle movements is expected to at least double to in excess of 6,500 a day. Agriculture contributes $13.7b GRP to Queensland, with a significant portion moved via the range crossing.

The success or otherwise of the Commonwealth and Queensland Government strategies of doubling agricultural production is also predicated on linkages to export markets via air and sea. The road network will have a key role to play in providing access to the Port of Brisbane, Brisbane Domestic and International Airpots and the new airport at Wellcamp.

Regional growth opportunities such as the Charlton Wellcamp Enterprise Area, the Brisbane West Wellcamp Airport and the proposed InterlinkSQ Freight Precinct will also likely be constrained should the TSRC not enable increased movement and greater productivity in supply chains.

As the current range crossing is now at capacity, the above economic growth opportunities would be significantly constrained without the TSRC and supporting east/west infrastructure in place to provide higher levels of road transport productivity than currently available.

Reference design – vehicle combination

The industry forum held during this project clearly indicated dissatisfaction with the choice of a B-Triple as the specified reference design vehicle. Participants advised the reference design vehicle should be based on a PBS level of access equivalent to the B-Triple: a PBS Level 3. Configuration of the B-Triple may not suit some commodities, such as for the carriage and tipping of bulk grain.

Through this approach, a degree of future-proofing will occur with respect to future technological advances in this level of performance-based access. B-Triples are commonly used now, accessing the western boundaries of Toowoomba. Using B-Triple as the reference design will not fully future-proof the TSRC, only enable a benefit that is available, but not yet fully realised.

With respect to pavement design, HML combinations, such as the A-Double, carrying two heavy loaded export 40-foot containers, and OSOM movements, should be considered in terms of axle loadings and how they influence the pavement design.

Summary of benefits and practical opportunities

Around 3,350 heavy vehicle movements cross the Toowoomba range a day. Based on the analysis framework used, approximately 70%, or 2,345, of those movements should be able to use the TSRC, subject to access available to the west and east of the TSRC.

The predominate users are likely to be:

- export containerised meat
- export grains, bulk and containerised
- export cotton products, bulk and containerised
- livestock carriers to Dinmore
- through freight movements.

Toowoomba-destined FMCG and general freight supply chains using general access vehicles are not likely to be early adopters. This decision will be influenced by the intermediate interchange at Mort Street, access, and toll cost versus benefits. However, FMCG and general freight vehicles destined for regions west of Toowoomba will most likely be early adopters of the TSRC. Horticultural movements would also fit this profile.

Subject to final geometric design, OSOM may also be a user and, subject to emergency response and fire-suppression systems and designs, fuel and dangerous goods transport may embrace the TSRC.

The potential number of forecasts movements through the TSRC will ultimately be influenced by access either side of the TSRC.

24 Toowoomba Second Range Crossing Project Fact Sheet March 2014 Australian and Queensland Governments

Access west and east of TSRC

As access for Type 1 and B-Triple combinations already exists at the major TSRC interchanges of the Warrego and Gore Highways, the ability to enter and exit the TSRC for these PBS Level 3 combinations will be in place from the outset. However, to the east, comparible access does not exist, nor has been proposed for the TSRC or the Warrego Highway Upgrade Strategy. The analysis would indicate a number of options would be required to enable the full benefits from the TSRC as follows:

- Brisbane East, Brisbane South, Logan and Ipswich locations have access to the PBS Level 3 combinations, and/or
- a de-coupling yard is located, based on a logistics centroid analysis to service the above high freight transport intensity areas.

This would result in the greatest productivity gain in terms of the unit of movement from the TSRC, leading to an overall reduction in the number of movements in higher productivity combinations.

Should this not be achievable, a de-coupling yard is required to the east of the TSRC and before reaching the above locations. This is a fundamental requirement for a vehicle combination based on the reference design to be able to use the TSRC from day one.

In addition, industry should be advised as early as possible that for movements to the east of the TSRC to be fully aligned with the TSRC reference design vehicle (B-Triple or equivalent), access will be by way of the NHVR Permit Scheme, or by way of NHVR Notice - or a combination of the two schemes. This will allow industry to develop corresponding responses and confirm key TSRC users.

TSRC infrastructure reference design

The overall reference design as currently proposed was widely accepted at the industry forum. To ensure future-proofing, the following initiatives are proposed:

- pavement strength be designed to ensure the majority of HML and OSOM loads can use the TSRC
- height clearance be increased to 5.6 m in the tunnels to increase the OSOM movements to 90% from the forecast 78% at 5.3 m
- allowance in width in tunnel to provide a road shoulder for vehicle run-off
- for increased height clearance, innovative designs be developed for the signage and fans located in the top section of the tunnel
- signaling and intersections be designed to cater for the PBS Level 3 type vehicles
- tunnels be equipped with fire-suppression and emergency response resources to allow fuel and bulk dangerous goods through the TSRC tunnels.

Policy imperatives

As supply chain networks require a collaborative end-to-end approach to achieve required levels of efficiency, so will Queensland Government planning. This report has identified potential misalignment between the following four key initiatives:

- TSRC reference design
- Warrego Highway Upgrade Strategy
- Heavy Vehicle Action Plan
- Draft Toowoomba Region Sustainable Transport Strategy.

Consideration should be given to review these four strategies, along with those that govern access to the Brisbane East, Brisbane South, Logan and Ipswich areas, to ensure the maximum benefit in terms of movement productivity is realised from the TSRC as early as possible.

Link to inland highway and a resilient road network

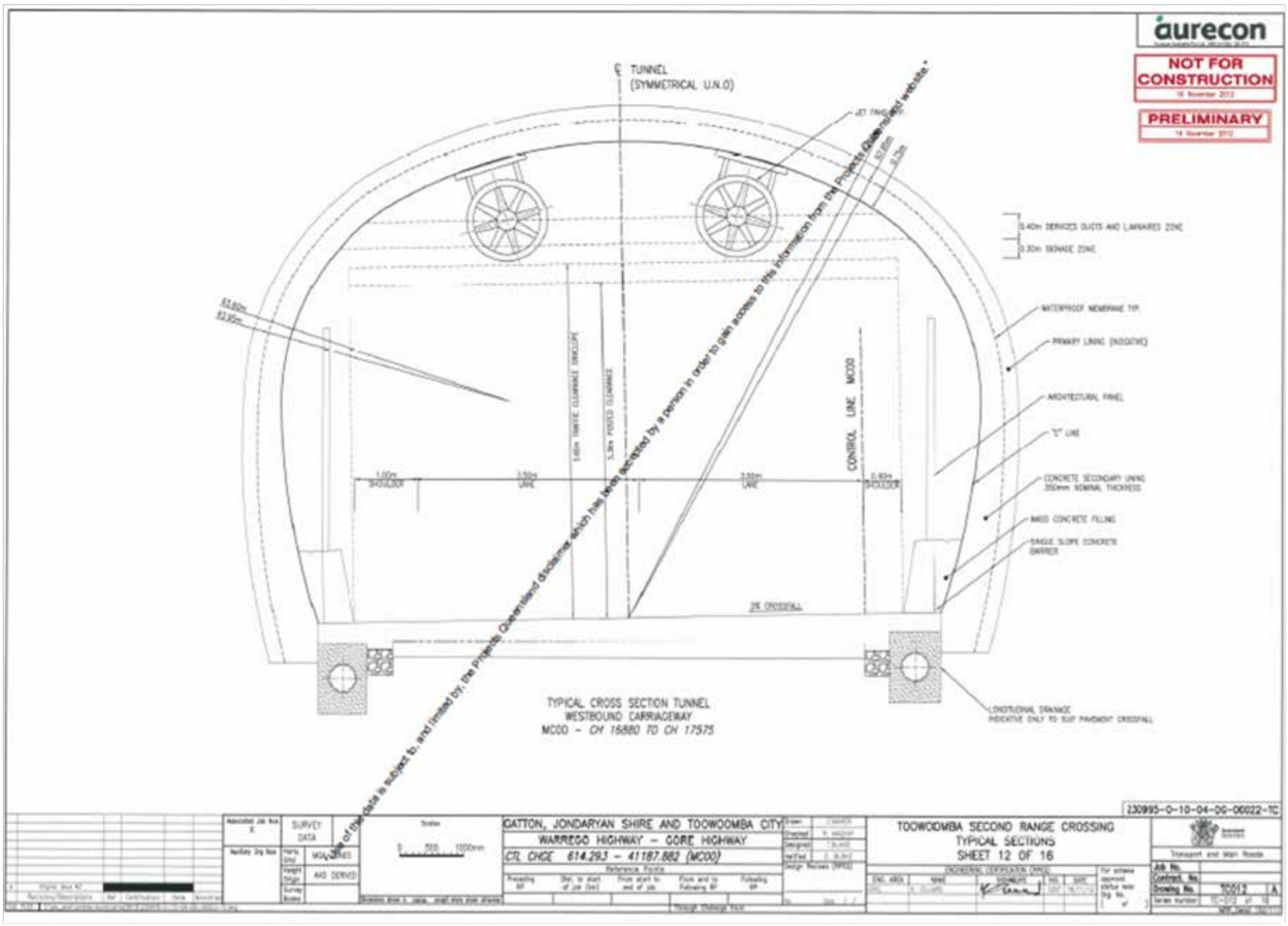
The TSRC is a key piece of infrastructure nationally and for Queensland. The focus of this project has predominately been on supply chains that tend to travel east/west and vice versa, with livestock and general freight movements into outback Queensland and Northern Territory travelling in a diagonal route from South East Queensland to the north-west. What has not been investigated in detail are supply chains that move in the north/south, and reverse direction.

This report has identified that while informal discussion has started regarding an inland highway, little formal work has occurred to date.

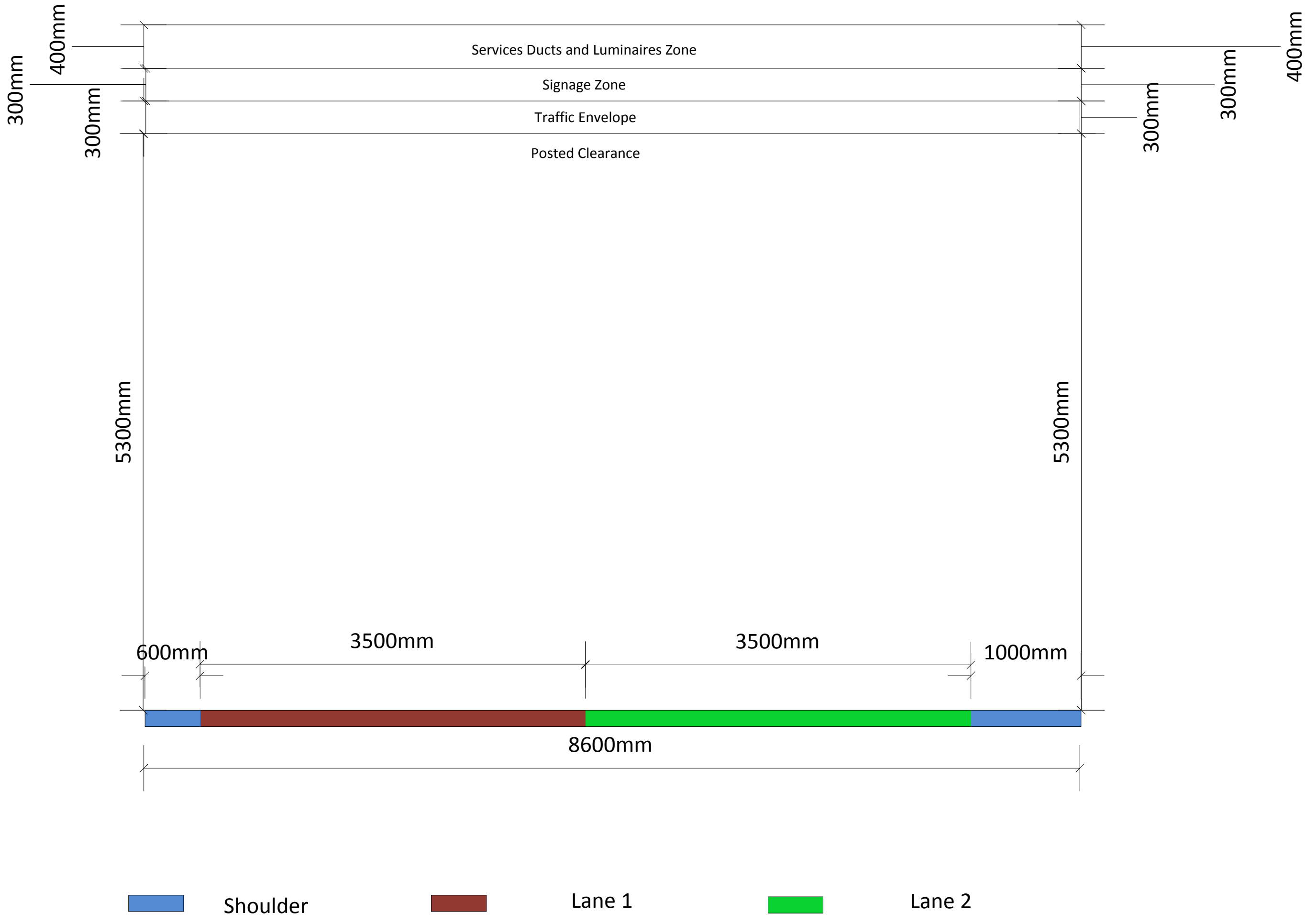
The investment in the TSRC is significant. The inland highway needs to be understood in terms of which supply chains would use it, their unit of movement, and what benefits that would accrue as a result - together with the dependencies to the TSRC and the Warrego Highway West and the linkages to the southern states. Without this understanding, an inland highway is unlikely to produce the maximum supply chain benefit for the economy of Queensland.

APPENDIX A: TSRC Reference design

➲ TUNNEl CROSS SECTION



TUNNEL DIMENSIONS



VEHICLE REFERENCE DESIGN

Design element	Design Vehicle	Remarks
Main TSRC Alignment	Austroads 36.5 m long B - Triple	Current TMR approved B-triples operate west of Toowoomba only, refer to Appendix A. However, it has been assumed that by designing the TSRC for B-Triples this allows B-Triples to travel down the Toowoomba Range to the Port of Brisbane. If this is not the case, then there is an opportunity to adopt the design vehicle as B-double from Warrego Highway (East) intersection to Warrego Highway (West) intersection.
Warrego Highway East Interchange	Austroads 36.5 m long B - Triple	
Warrego Highway West signalised intersection	Austroads 36.5 m long B - Triple	
Mort Street, including interchange	Austroads 25 m long B - Double	Refer to Appendix A.
Hermitage Road	Austroads 25 m long B - Double	Refer to Appendix A.
Cecil Plains Road intersection	Austroads 36.5 m long B - Triple	Refer to Appendix A.
Gore Highway intersection	Austroads 36.5 m long B - Triple	Refer to Appendix A.
All other local roads	Austroads 19.0 m long articulated semi-trailer	

PAVEMENT REFERENCE DESIGN

2.3 Pavement design

For the pavement design, the following design standards and guidelines will be used:

- Austroads
  - A Guide to the Structural Design of Road Pavements
- Department of Transport and Main Roads
  - Pavement Design Manual

There are various design scenarios and design life available for the pavement design. The following are the key departures from the above design guidelines proposed for TSRC:

- Design life of 20 years as opposed to 40 years
- Lane distribution factor of 0.9 as opposed to 1.0 in the sections where two lanes in each direction ie From Warrego Highway east to Mort St
- 95% project reliability as opposed to 97%
- Granular pavement instead of High Load intensity, Low Intervention (HILI) pavement for the section between Warrego Highway west intersection and Gore Highway intersection

➲ SUMMARY REFERENCE DESIGN

Road Section	Description	Design Vehicle	Design Speed/ km/h	Posted Speed/ km/h	Typical Cross Section		Minimum Vertical Curve		Minimum Horizontal Curve	Minimum Vertical Clearance/ m	Maximum Vertical Grade/ %
					Cut	Fill	Crest	Sag			
1	Warrego Hwy East to Gittens Road Overpass	36.5m long B- Triple[5]	110	100	Type 1	Type 2	9730	5100	794	TBC	5.0
2	Gittens Road Overpass to Tunnel (eastern Portal)	36.5m long B- Triple[5]	100	90	Type 1	Type 2	7140	4200	656	TBC	6.7
3	Tunnel	36.5m long B- Triple[5]	100	80	TBC	NA	7140	4200	656	TBC	5.0
4	Tunnel (western portal) to Mort Street	36.5m long B- Triple[5]	100	80	Type 1	Type 2	7140	4200	656	TBC	5.0
5	Mort Street to Warrego Hwy (West)	36.5m long B- Triple[5]	110	100	Type 1/ Type 3	Type 2/ Type 4	9730	5100	794	TBC	5.0
6	Warrego Hwy to Gore Hwy	36.5m long B- Triple	110	100	Type 3	Type 4/ Type 5	9730	5100	794	TBC	5.0

Notes:

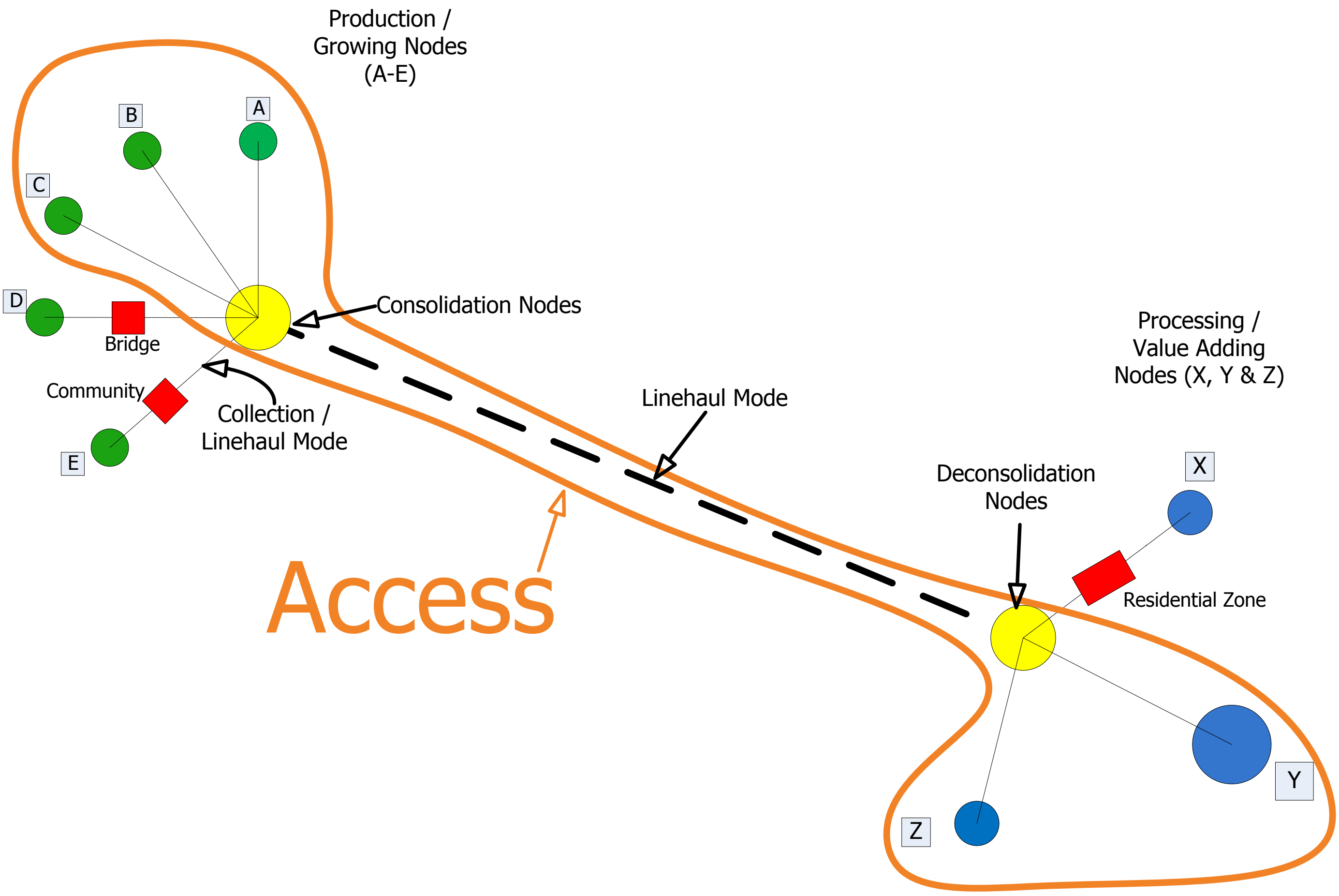
- Mort Street and Hermitage Road will be designed for B-Double
- Cecil Plains Road will be designed for B-Triple
- All other local roads will be designed to 19m articulated semi-trailer
- Vertical clearance over local roads (underpass bridges) has to be maintained as per current clearances maintained by Toowoomba Regional Council/ Lockyer Valley Regional Council
- Opportunity to adopt B-double as the design vehicle from Warrego Hwy West to Warrego Hwy East for the main alignment. This depends on TMR strategic planning on Warrego Hwy to Port of Brisbane
- Refer Appendix B for Typical Cross Sections

➲ SUMMARY DESIGN PARAMETERS

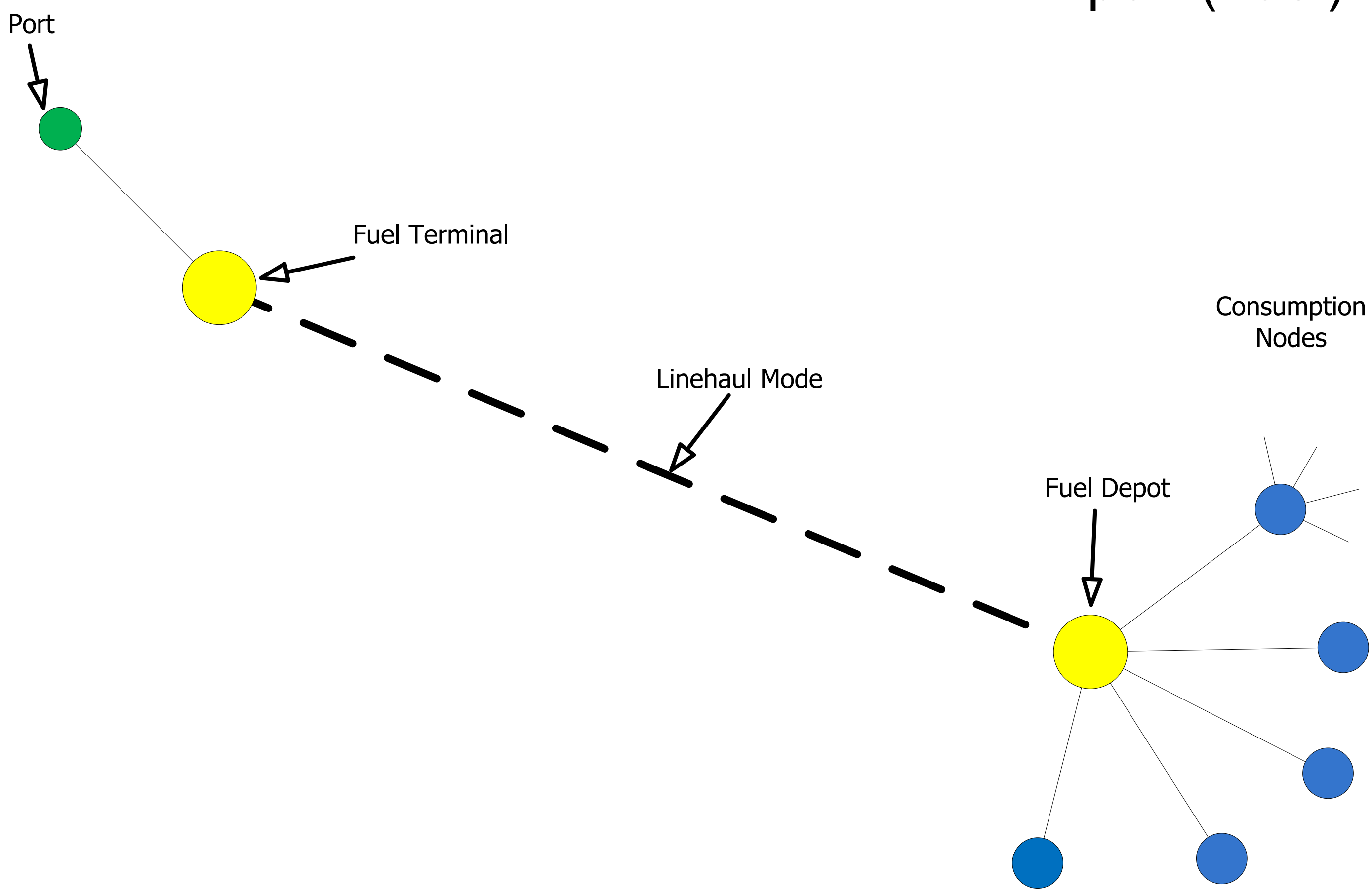
Design Parameter	
Design Speed (Posted Speed)	100 km/h (80 km/h) - Light vehicles Note: Heavy vehicles will operate at lower speed due to TSRC grades. VEHSIM modelling has been undertaken to determine truck operating speeds. Refer to Appendix B.
Design Vehicle	36.5 m long B-Triple
Clearance Height	5.3 m posted vehicle clearance envelope (0.3m additional clearance to allow for signage, ventilation and visibility) Note: Over-dimensional vehicles with height >5.3 m can use the existing Toowoomba Range Crossing.
Cross section	Twin tunnel with two lanes with the following lane configuration: 1.0 m*/3.5 m/3.5 m/0.6 m* (Total cross section 8.6 m, barrier to barrier) * Complies with Austroads Clause 4.6.5
Grade	4.7%, flattening to about 3.5% at the crest
Design life	100 years
Design flood immunity	1 in 100 years ARI at portal
Vertical alignment (minimum)	5,000 m sag curve radii 9,800 m crest curve radii
Horizontal alignment (minimum)	680 m curve radii

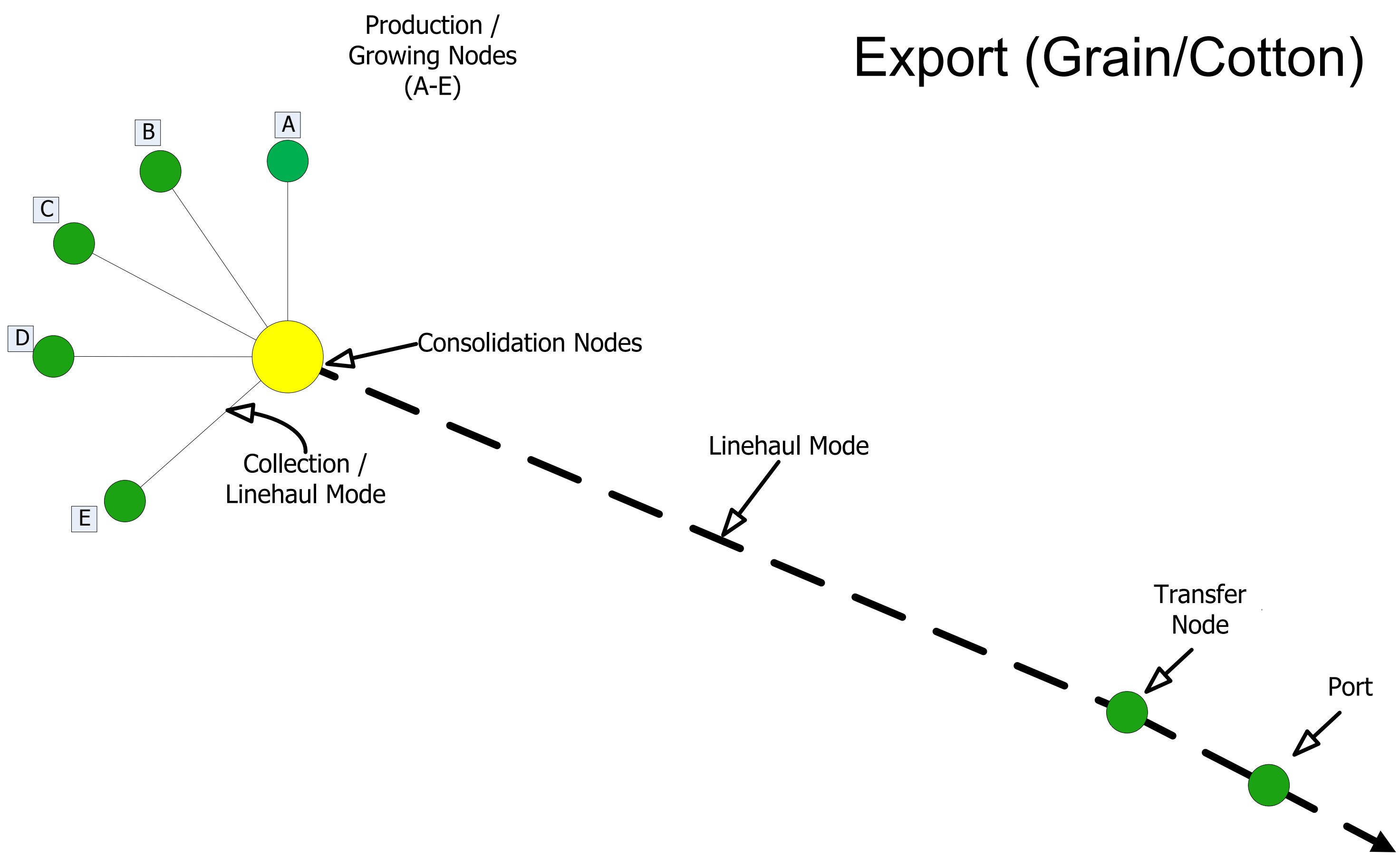
APPENDIX B: Supply chain network diagrams

The diagram below is a demonstration example, with the following being Industry/Sector specific.

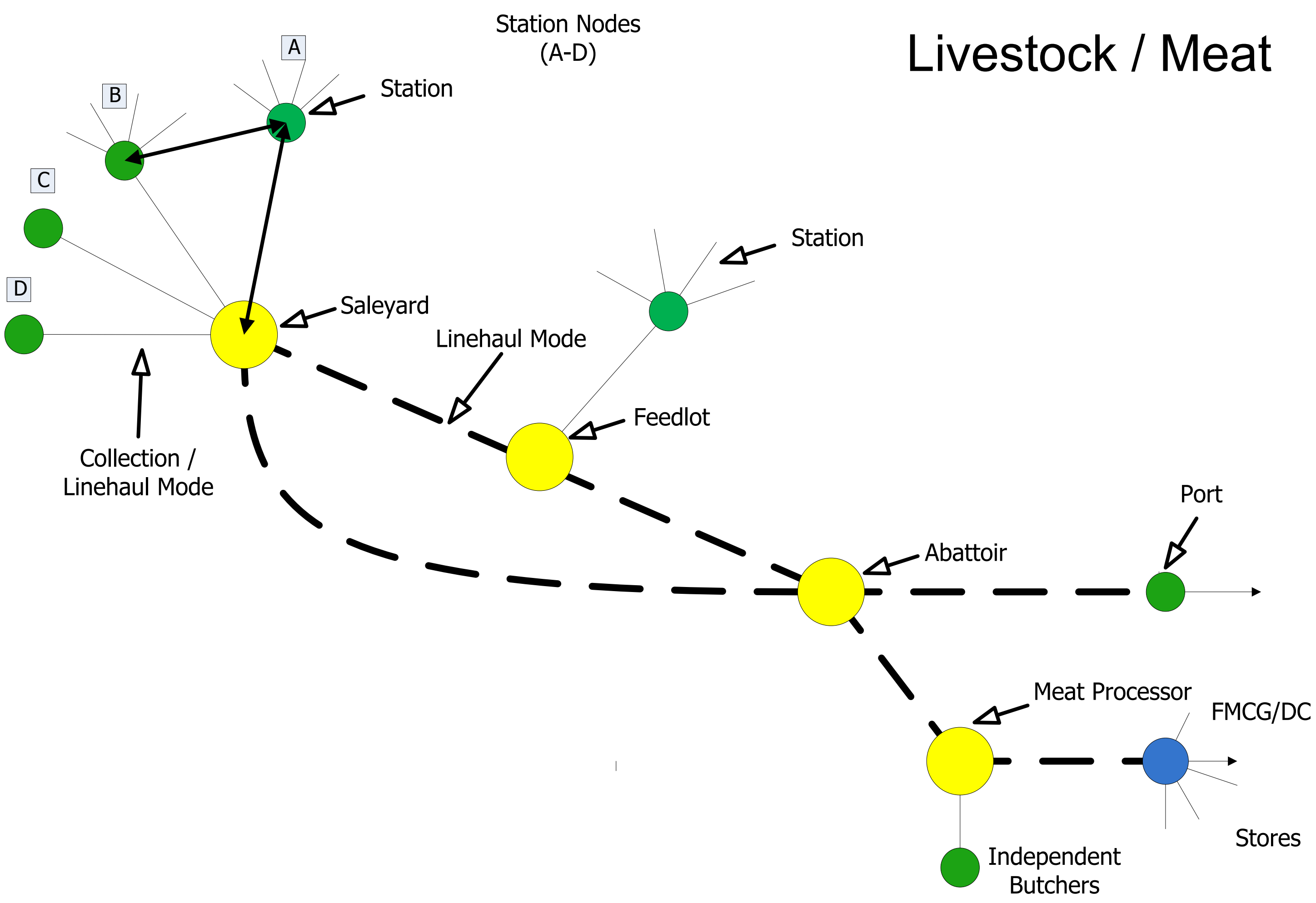


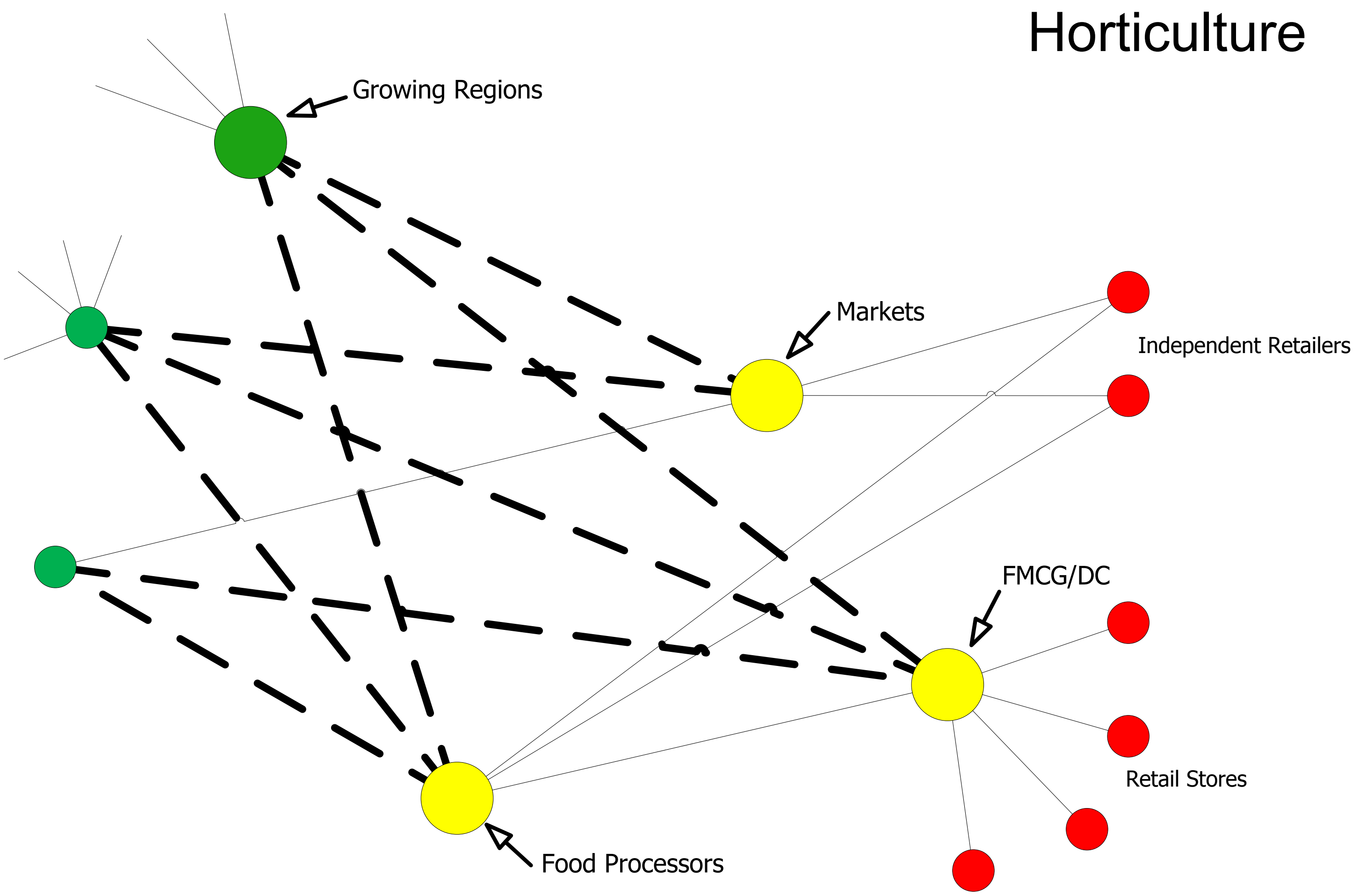
Import (Fuel)


Port
Fuel Terminal
Linehaul Mode
Consumption Nodes
Fuel Depot

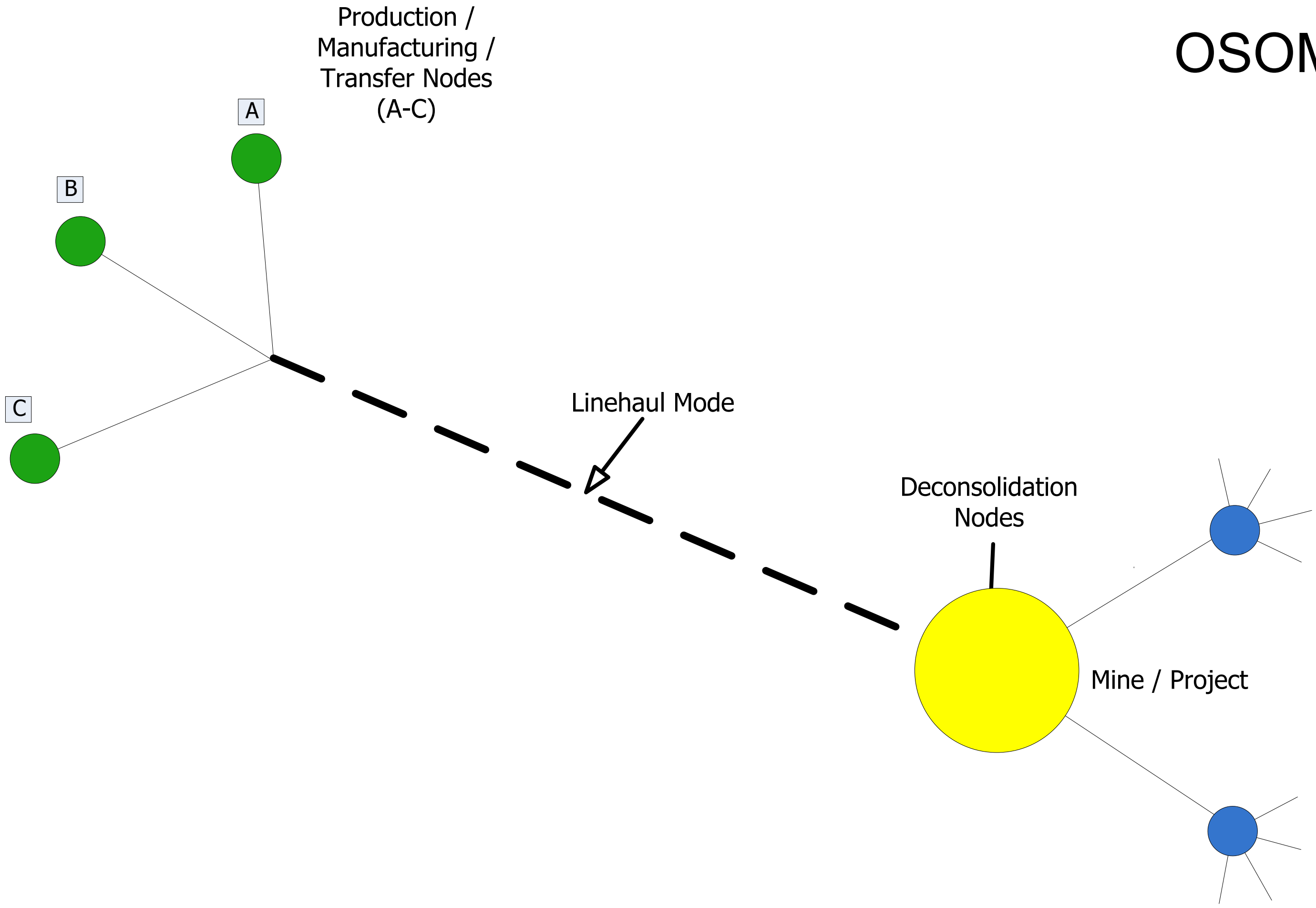

Export (Grain/Cotton)
Production /
Growing Nodes
(A-E)
A
B
C
D
E
Consolidation Nodes
Collection /
Linehaul Mode
Linehaul Mode
Transfer
Node
Port

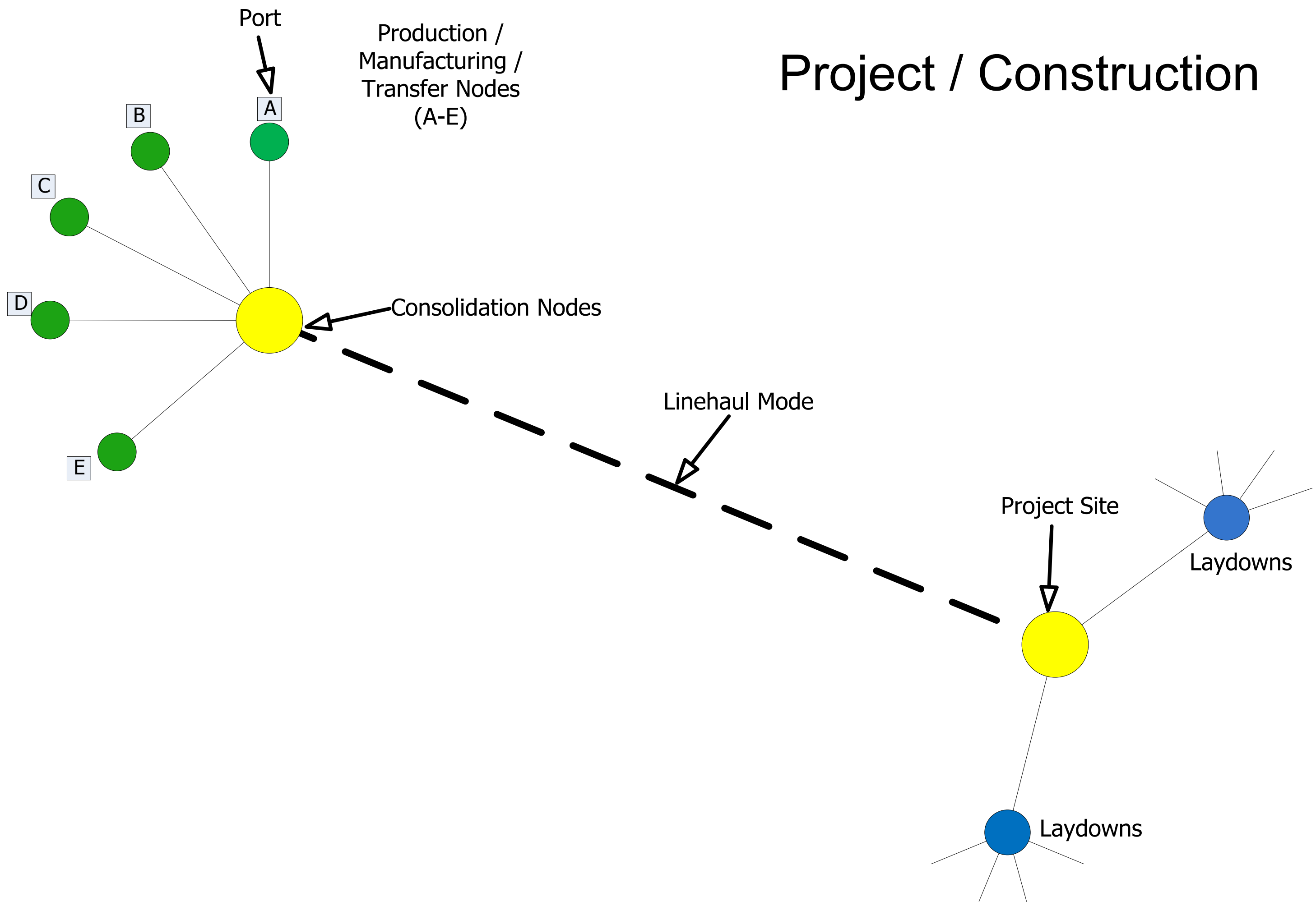
Livestock / Meat




Horticulture
Growing Regions
Markets
Independent Retailers
FMCG/DC
Retail Stores
Food Processors

OSOM


Production /
Manufacturing /
Transfer Nodes
(A-C)
A
B
C
Linehaul Mode
Deconsolidation
Nodes
Mine / Project


Port
Production /
Manufacturing /
Transfer Nodes
(A-E)
Project / Construction
A
B
C
D
E
Consolidation Nodes
Linehaul Mode
Project Site
Laydowns
Laydowns

QTLC
QUEENSLAND TRANSPORT
AND LOGISTICS COUNCIL