LAND AND WATER
www.csiro.au

Transport Network Strategic Investment Tool (TraNSIT)

Application to Northern Australia Beef Roads Programme

April 2016

CITATION

CSIRO (2016) Transport Network Strategic Investment Tool (TraNSIT) – Application to Northern Australia Beef Roads Submissions. CSIRO, Australia.

COPYRIGHT AND DISCLAIMER

IMPORTANT DISCLAIMER

This initiative has been part funded by the Australian Government.

Contents

1 Background

CSIRO's *Beef Roads Project* informs the Australian Government's $100 million Northern Australia Beef Roads Programme, which forms part of "Our North, Our Future: White Paper on Developing Northern Australia". The project uses the TraNSIT tool to estimate cost savings to cattle transport for a range of road infrastructure scenarios across northern Australia.

TraNSIT (the Transport Network Strategic Investment Tool) is a computer-based tool that assesses expected savings associated with infrastructure investments and policy changes impacting commodity transport. The outputs provide information allowing for objective assessment of investment options.

Following two stakeholder roundtable workshops in Rockhampton (October 2015) and Kununurra (November 2015), information was provided to CSIRO by several stakeholders, outlining the location and nature of 60 proposed infrastructure changes. They included sealing gravel roads, upgrading road access to allow for use by higher productivity vehicles, upgrading bridges to reduce inaccessibility from flooding, and upgrading intersection access to key facilities. This information was used by CSIRO to model each scenario.

Outputs from the TraNSIT model allow comparison of expected savings between different scenarios, and also between baseline (current) and changed conditions for each scenario. This report provides the cost savings for the transport of cattle for each submission, along with impacts of beef freight flows along the road network. It is recommended that the reader refers to Section 3 first, which provides important information about the scope of the analysis and interpretation of the results. The cost savings include transport costs, loading and unloading, decoupling and fatigue management costs, and return trips of empty trailers. The calculation of cost savings is confined to beef transport and may, in many instances, be many times greater when other industries and road users are considered. For many of the scenarios, co-benefits for other road users, communities and the environment are achieved, but have not been quantified in our analyses.

1.1 TraNSIT

To provide a holistic view of the benefits associated with infrastructure investments and policy changes across agriculture supply chains, CSIRO developed the Transport Network Strategic Investment Tool (TraNSIT). Initially developed in 2012/13 for northern Australia with co-funding by the Australian Government's Office of Northern Australia, and the Northern Territory, Western Australian and Queensland Governments, the tool was built to assess the cattle supply chains in northern Australia. New modules are being developed for application to other commodities.

TraNSIT can provide stakeholders with advice on both small- or large-scale investments in the agriculture supply chains, and the benefits to all enterprises, including:

- analysing the impact of road upgrades (such as sealing or improving for higher combination vehicles), where the financial benefits to individual agricultural enterprises and to the industry as a whole are quantified;
- optimising the use of road versus rail transport and their integration, at different locations;
- optimally locating new supply chain infrastructure facilities (e.g. abattoirs and spelling yards);
- testing potential outcomes for changes in policy, e.g. alignment of driver and animal welfare stops, changing truck limitations for road classes, removal of tick-clearing regulations for cattle transported directly to abattoirs;
- selecting infrastructure investment and regulatory change opportunities that maximise transport cost reductions for a given investment budget.

To evaluate and optimise capital investments and operations in commodity logistics, TraNSIT combines information on commodity supply chains with information on the road/rail network, heavy vehicle access and regulatory constraints covering driver fatigue and biosecurity protocols. TraNSIT performs a mass optimal routing of vehicle movements between the (sometimes) thousands of enterprises in the specific commodity industry, and provides industry- or locality-wide logistics costs. This enables testing of logistics opportunities that could benefit thousands of enterprises. A more detailed description of TraNSIT is contained in Appendix A.

2 Baseline Analysis

A baseline analysis provides information on the number of vehicles travelling along each road/rail segment, and needs to be undertaken before scenarios can be run and assessed.

In the application of TraNSIT to cattle across the whole of Australia, this baseline analysis was run for an average year between 2008 and 2013, and the 2013/2014 FY for live export (to capture a full export year). It was derived by mapping the path of about 80,000 origin to destination movements, representing 20 million cattle transported in a given year. A summary map for all cattle vehicle movements is provided in Figure 1.1. The line between Devonport and Melbourne represents cattle shipped between Tasmania and the mainland. There is a similar line between Kangaroo Island and the mainland of South Australia.

The vehicle counts in Figure 1.1 take into consideration whether the vehicle is a Semi Trailer, B-Double, Type 1 or Type 2 road train. The largest vehicle counts are those on major corridors towards large abattoirs, feedlots and saleyards along the east and southern coast. There is a large number of interstate vehicle trips - particularly cattle transported to abattoirs and feedlots between Queensland and New South Wales. A significant number of cattle are transported from the Northern Territory to Queensland, particularly enroute to feedlots and abattoirs. Figure 1.2 shows the rail component of the cattle transport.

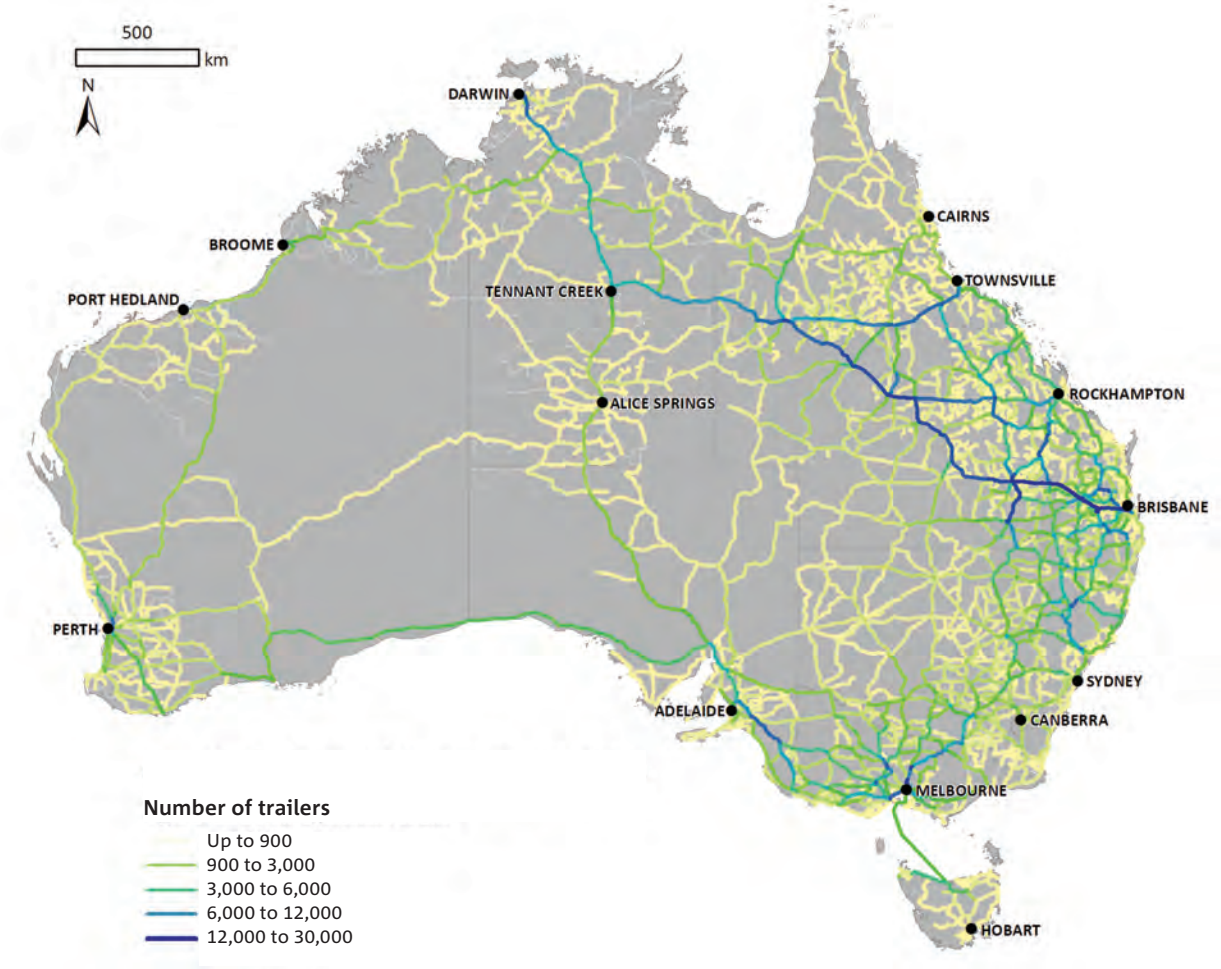

Figure 1.1: Cattle vehicle numbers (semi-trailer equivalents) across the Australian road network as estimated by TraNSIT, for an average year between 2008 and 2013

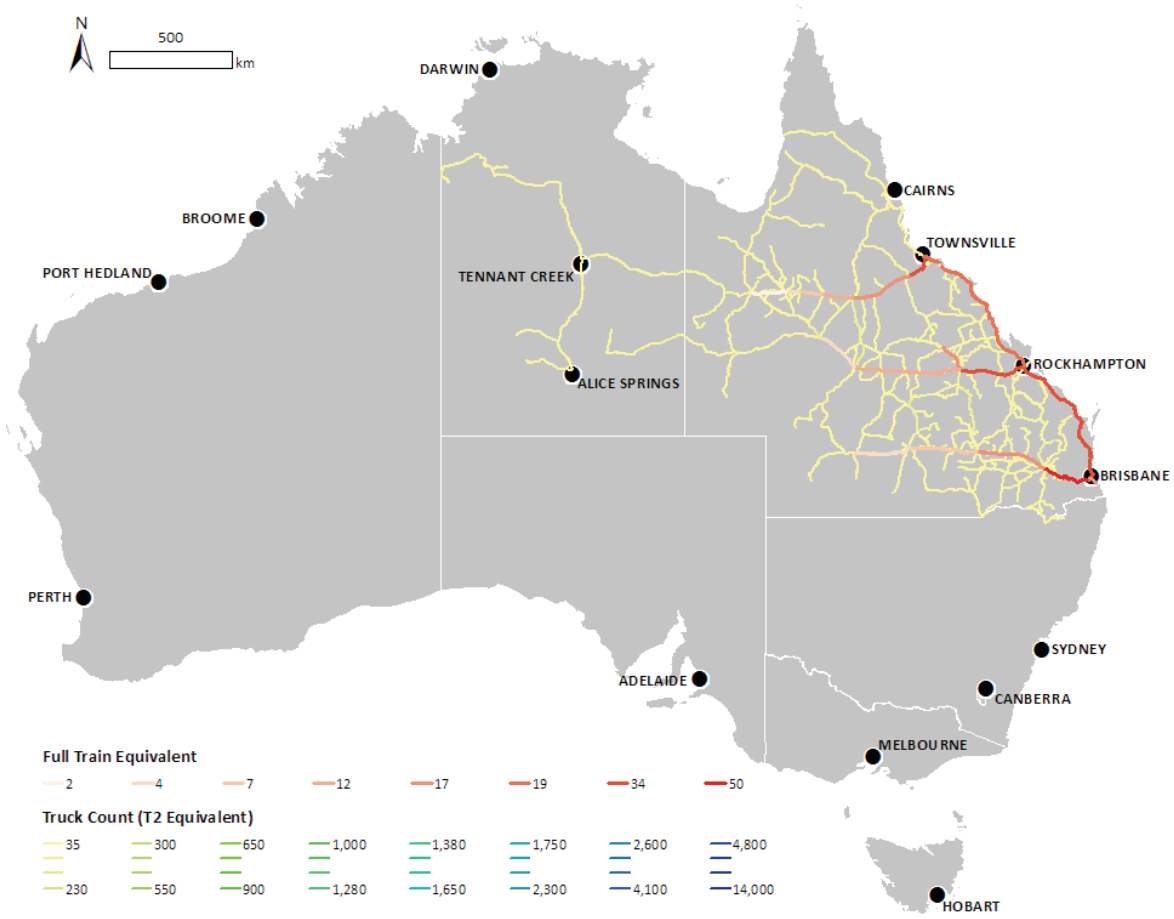

Figure 1.2: Rail transport component for the baseline scenario of Figure 3. The figure includes the road component of travel to the rail loading points.

The total cost of cattle transport across Australia is about $262 million (Table 1.1) which almost doubles to about $490 million if return trips of empty trailers (i.e. no backloading) are considered. Total costs vary substantially between States and Territories, mainly due to the number of cattle transported. Costs per head are based on each supply chain link. For example, transport from a property to feedlot then to an abattoir is two separate trips with separate costs. The same applies to transport from property to export depot then to port.

TABLE 1.1: SUMMARY OF CATTLE TRANSPORT COSTS ACROSS AUSTRALIA

	BASE
Travel	$209,425,033
Fatigue	$12,126,314
Decoupling	$6,288,947
Other costs	$34,361,098
Total with cattle	$262,201,393
Return journey of empty trailers	$227,840,295
Total cost	**$490,041,689**

3 Application to Beef Roads Submissions

The following section shows the modelled transport cost savings for each road upgrade scenario provided by stakeholders for consideration for the Northern Australia Beef Roads Programme. It is separated into submissions for Northern Territory (Section 4), submissions for Queensland (Section 5), submissions for Western Australia (Section 6) and other (Section 7). The order that the scenarios were analysed and presented do NOT reflect any prioritisation or any priorities nominated in the submissions.

To implement each road upgrade scenario, the road network used for the baseline analysis was modified to represent the scenario using information provided in the submission. Subtracting the TraNSIT outputs for the scenario from the baseline provides the transport cost savings for the road upgrade.

3.1 Scope of the analysis

The transport cost savings shown in this report include:

- travel costs
- reductions in decoupling and reconnecting the vehicles
- efficiencies of higher productivity vehicles
- reductions in costs of stoppage times for driver rests (in accordance with driver fatigue guidelines).

Some road upgrade scenarios will create additional benefits, which the current version of TraNSIT does not show. These include:

- reduced vehicle wear and tear and maintenance, from less travel on unsealed roads, or part travel on narrow sealed roads. While this will be included in a future version of TraNSIT, it is not accounted for in the following results.
- reduced slow down and acceleration from passing on narrow roads, as well as less congestion
- additional economic growth that may take place as a result of sealing large road corridors in the north
- increased road safety for all road users, and increased health and safety for drivers
- improved animal welfare from reduced travel on unsealed roads
- reduced dust

3.2 Interpretation of results

Each scenario contains a figure showing the road segments impacted and the type of upgrade implemented; and a table showing the summary of results. For scenarios where there is a large increase in the number of cattle using the road after the upgrade, an additional figure is provided to show the changes in freight flows across the road network.

Each table shows transport cost savings broken down into several components:

- travel – savings in transport costs along the road segments being upgraded
- vehicle break down – savings in terms of reduced number of vehicles decoupling and reconnecting
- broader network – additional savings from additional vehicles using the road versus their previous alternative route; and greater use of higher production vehicles in the travel path before the road segment upgraded

The “Trailers Per Annum” column is the weighted number of semi-trailer equivalents using the road corridor. This includes the return trip of empty trailers without cattle. It is weighted by the number of trailers on each segment within the corridor. For example, consider a 100 km road corridor that contains two road segments of 30 km and 70 km, with the first segment containing 10 vehicles and the second segment containing 80 vehicles. The weighted number of trailers is calculated as (10*30+80*70)/100 = 59 trailers. The “Trailers Per Annum” column reflects the number of trailers using the route in the baseline analysis, and the “Trailers After Upgrade” are the number of trailers that are predicted to use the route following the proposed upgrade. Where the number of “Trailers After Upgrade” is greater than the “Trailers Per Annum” the improvement has resulted in a re-route of vehicles.

4 Northern Territory Submissions

4.1 Widening the Buntine Highway between Lajamanu Road and the Victoria Highway and sealing 20km west of Lajamanu Road

DESCRIPTION OF THE MODELLED SCENARIO

Part of the Buntine Highway between Halls Creek (WA) and Willeroo (NT) is currently unsealed. For this scenario, the segments of road classed as unsealed were sealed (Figure 4.1).

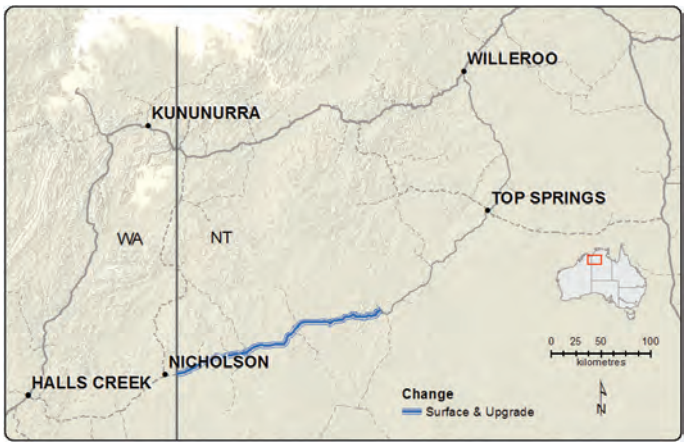

Figure 4.1: Widening Buntine highway between Lajamanu road and Victoria Highway and seal 20km west of Lajamanu road

SUMMARY OF RESULTS

Table 4.1 summarises the cost savings per annum. Savings per annum for the modified parts of the road network are $13,720 for driving (i.e. when the vehicle is moving). The additional savings of $29,323 across the connecting road network are due to more vehicle trips using more efficient routes and/or configurations as a result of sealing these parts of the Buntine Highway. These savings include the costs associated with the return journey of empty trailers.

TABLE 4.1: SUMMARY OF SAVINGS IF PARTS OF THE BUNTINE HIGHWAY ARE FULLY SEALED BETWEEN HALLS CREEK AND WILLEROO

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TRAILERS AFTER UPGRADE	SAVINGS PER HEAD
Travel	$13,720			
Vehicle break down	$0			
Broader network	$29,323			
Total	**$43,043**	**290**	**290**	**$2.71**

4.2 Widening part of the Tablelands Highway

DESCRIPTION OF THE MODELLED SCENARIO

This scenario involves upgrading part of the Tablelands Highway from narrow single lane seal to two-lane seal, and creating additional flood immunity improvements (Figure 4.2).

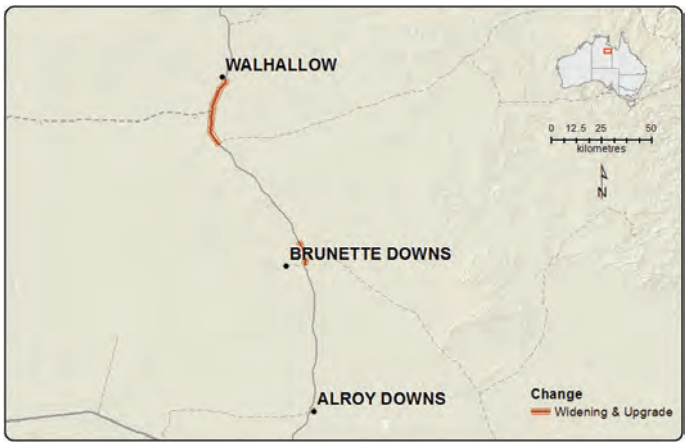

Figure 4.2: Locations of narrow single sections to be widened

SUMMARY OF RESULTS

Table 4.2 summarises the cost savings per annum, based on full vehicles (single trailers). These savings include the costs associated with the return journey of empty trailers.

TABLE 4.2: SUMMARY OF ANNUAL SAVINGS FROM WIDENING PARTS OF THE TABLELANDS HIGHWAY

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TRAILERS AFTER UPGRADE	SAVINGS PER HEAD
Travel	$30,756			
Vehicle break down	$0			
Broader network	$0			
Total	**$30,756**	**2052**	**2052**	**$0.41**

4.3 Sealing unsealed sections of the Tanami Road

DESCRIPTION OF THE MODELLED SCENARIO

Parts of the Tanami Road between Halls Creek (WA) and Alice Springs (NT) are unsealed. For this scenario, the unsealed segments of road were sealed (Figure 4.3).

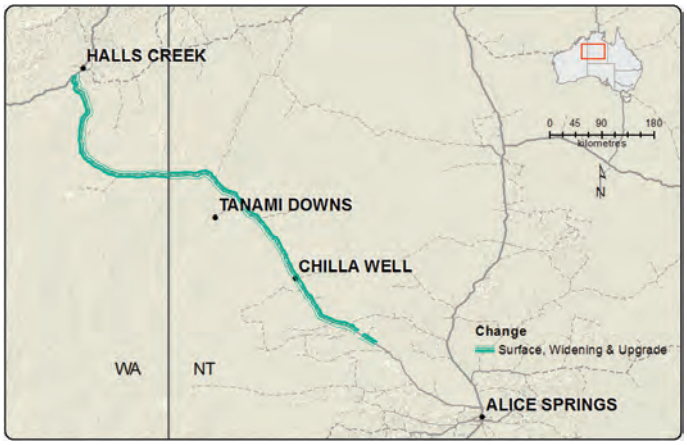

Figure 4.3: Segments of Tanami Road between Halls Creek and Alice Springs sealed according to the scenario

SUMMARY OF RESULTS

Table 4.3 summarises the cost savings per annum. Savings for the modified part of the road network are $95,324 for driving. Across the broader network, savings of $20,060 are due to the more efficient use of roads and/or truck configurations due to this upgrade. These savings include the costs associated with the return journey of empty trailers.

TABLE 4.3: SUMMARY OF SAVINGS IF SEALING OF UNSEALED SECTIONS OF THE TANAMI ROAD

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TRAILERS AFTER UPGRADE	SAVINGS PER HEAD
Travel	$95,324			
Vehicle break down	$0			
Broader network	$20,060			
Total	**$115,384**	**184**	**296**	**$7.75**

4.4 Sealing unsealed sections of the Barkly Stock Route

DESCRIPTION OF THE MODELLED SCENARIO

Part of the Barkly Stock Route in the NT is unsealed. For this scenario, the unsealed segments of road (Figure 4.4) were sealed.

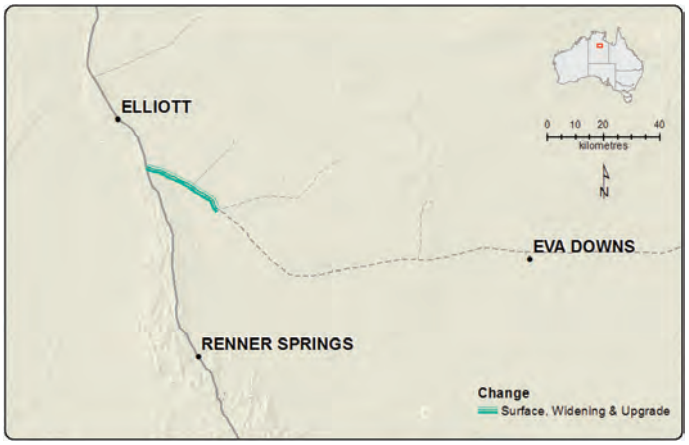

Figure 4.4: Segments of road along the Barkly Stock Route sealed according to the scenario

SUMMARY OF RESULTS

Table 4.4 summarises the cost savings per annum. Savings for the modified part of the road network are $9,395 for driving. Across the broader network, savings of $354 are due to the more efficient use of roads and/or truck configurations due to this upgrade. These savings include the costs associated with the return journey of empty trailers.

TABLE 4.4: SUMMARY OF SAVINGS IF PART OF THE BARKLY STOCK ROUTE IS SEALED ACCORDING TO THE SCENARIO

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TRAILERS AFTER UPGRADE	SAVINGS PER HEAD
Travel	$9,395			
Vehicle break down	$0			
Broader network	$354			
Total	**$9,749**	**452**	**454**	**$0.56**

4.5 Upgrading the entire Buntine Highway and Duncan Road from the Victoria Highway to Halls Creek

This scenario seals and widens the entire Buntine Highway and Duncan Road between Nicholson and Willeroo, as per Figure 4.5.

Figure 4.5: Sealing of entire Buntine Highway and Duncan Road

SUMMARY OF RESULTS

Table 4.5 shows the summary of savings, which include a significant increase in vehicle usage after the upgrade. Figure 4.5a shows the impact of the Buntine Highway upgrade on vehicle numbers (semi-trailer equivalents with cattle) across the network in that region. The blue numbers represent the number of trailers (with cattle) on the road segment before the upgrade and the red numbers after the upgrade. If the road is highlighted in blue, there is a net reduction in number of vehicles after the upgrade. If highlighted in red, there is a net increase in number of vehicles after the upgrade. In this case, the upgrade of the Buntine Highway reduced vehicle movements along the Great Northern Highway.

TABLE 4.5: SEALING OF BUNTINE HIGHWAY AND DUNCAN ROAD

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TRAILERS AFTER UPGRADE	SAVINGS PER HEAD
Travel	$125,233			
Vehicle break down	$0			
Broader network	$58,351			
Total	**$183,584**	**426**	**664**	**$5.39**

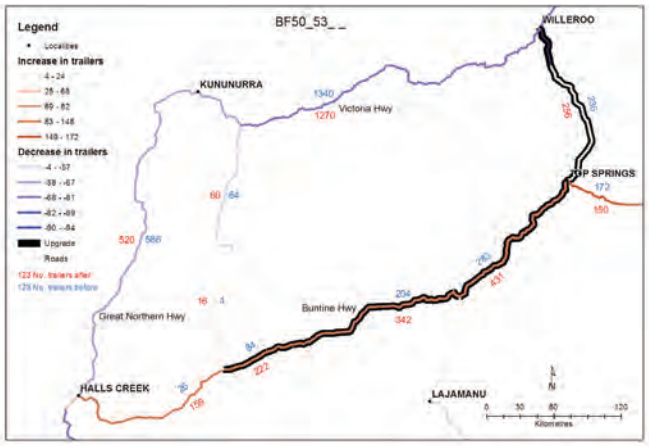

Figure 4.5a: Map of impact on freight flows. Trailer numbers (per annum) in the map are based on trips containing cattle and not the return journey of empty trailers

4.6 Sealing the Plenty Highway east to the Queensland border

DESCRIPTION OF THE MODELLED SCENARIO

The Plenty Highway is currently unsealed from its western extremity in NT (north of Alice Springs) east to the Queensland border. For this scenario, the sections of road (Figure 4.6) were sealed or widened.

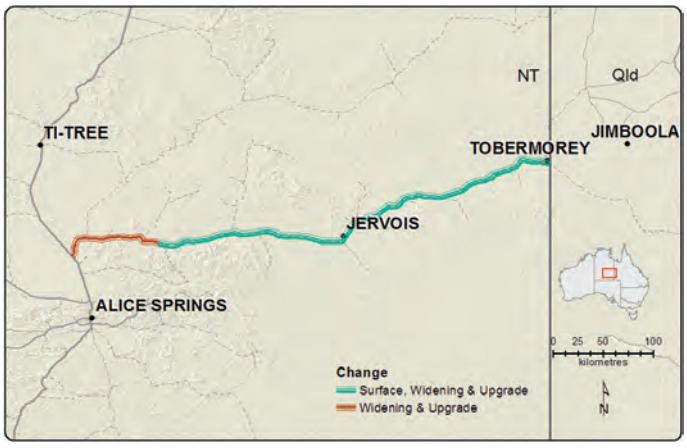

Figure 4.6: Segments of Plenty Highway between its western extremity and the Queensland border sealed

SUMMARY OF RESULTS

Table 4.6 summarises the cost savings per annum determined for the scenario. Savings for the modified part of the road network are $69,864 for driving and a further savings of $22,125 are due to the more efficient use of roads and/or truck configurations due to this upgrade. These savings include the costs associated with the return journey of empty trailers. The negative vehicle break down

savings are due to some vehicle trips taking this route after the upgrade, where the savings of taking this outweigh the additional costs of decoupling. Figure 4.6a shows the impact of the Plenty Highway upgrade on vehicle numbers (semi-trailer equivalents carrying cattle) across the network in that region. The blue numbers represent the number of trailers (with cattle) on the road segment before the upgrade and the red numbers after the upgrade. If the road is highlighted in blue, there is a net reduction in number of vehicles after the upgrade. If highlighted in red, there is a net increase in number of vehicles after the upgrade.

TABLE 4.6: SUMMARY OF SAVINGS FOR SEALING PLENTY HIGHWAY FROM ITS WESTERN EXTREMITY, EAST TO THE QUEENSLAND BORDER

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TRAILERS AFTER UPGRADE	SAVINGS PER HEAD
Travel	$69,864			
Vehicle break down	-$552			
Broader network	$22,125			
Total	**$91,437**	**486**	**785**	**$1.54**

Figure 4.6a: Map of impact on freight flows. Trailer numbers (per annum) in the map are based on trips containing cattle and not return journey of empty trailers

4.7 Sealing a 45km segment of the Buntine Highway

DESCRIPTION OF THE MODELLED SCENARIO

Sealing a selected 45km segment of the Buntine Highway (Figure 4.7).

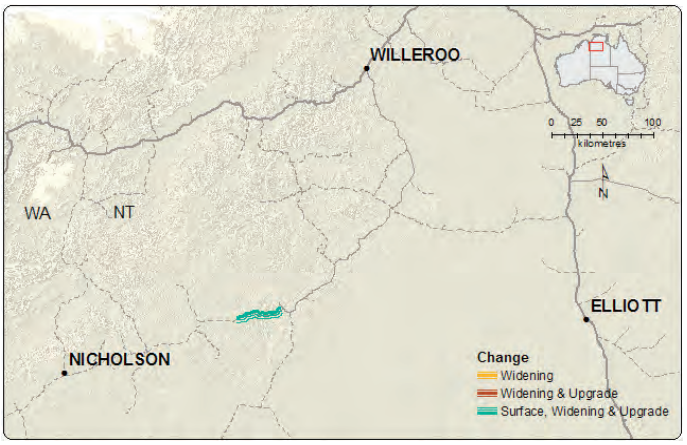

Figure 4.7: Sections of Buntine Highway to be upgraded

SUMMARY OF RESULTS

Table 4.7 summarises the cost savings per annum, based on full vehicles (single trailers). These savings include the costs associated with the return journey of empty trailers.

TABLE 4.7: SUMMARY OF SAVINGS IF A SELECTED 45KM SECTION OF THE BUNTINE HIGHWAY IS SEALED

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TRAILERS AFTER UPGRADE	SAVINGS PER HEAD
Travel	$4400			
Vehicle break down	$0			
Broader network	$7611			
Total	**$12,011**	**404**	**404**	**$0.88**

4.8 Upgrading part of Plenty Highway between Boulia and Alice Springs

DESCRIPTION OF THE MODELLED SCENARIO

Part of the Plenty Highway between Boulia (Queensland) and Alice Springs (NT) is currently unsealed. For this scenario, the segments of road classed as unsealed were sealed and widened, an existing sealed section was widened and sections were upgraded to accommodate maximum state speed (Figure 4.8).

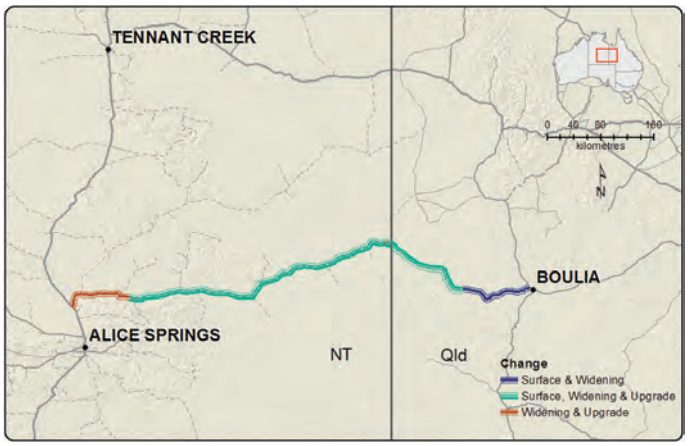

Figure 4.8: Segments of road between Boulia and Alice Springs to be upgraded

SUMMARY OF RESULTS

Table 4.8 summarises the cost savings per annum. Savings per annum for the modified parts of the road network are $236,019 for driving (i.e. when the vehicle is moving). Additional savings of $59,686 across the connecting road network are due to more vehicle trips using more efficient routes and/or configurations as a result of sealing these parts of the Plenty Highway. Figure 4.8a shows the impact of the upgrade on vehicle numbers (semi-trailer equivalents carrying cattle) across the network in that region. The blue numbers represent the number of trailers on the road segment before the upgrade and the red numbers after the upgrade. If the road is highlighted in blue, there is a net reduction in number of vehicles after the upgrade. If highlighted in red, there is a net increase in number of vehicles after the upgrade.

TABLE 4.8: SUMMARY OF SAVINGS IF PLENTY HIGHWAY IS FULLY SEALED BETWEEN BOULIA AND ALICE SPRINGS

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TRAILERS AFTER UPGRADE	SAVINGS PER HEAD
Travel	$236,019			
Vehicle break down	$0			
Broader network	$59,686			
Total	**$295,705**	**452**	**1136**	**$3.12**

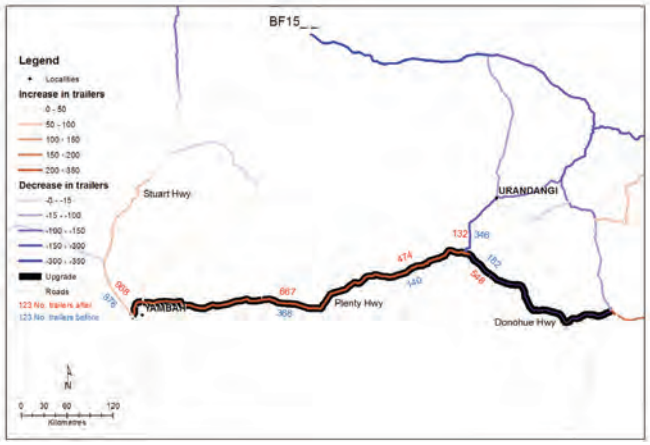

Figure 4.8a: Map of impact on freight flows. Trailer numbers (per annum) in the map are based on trips containing cattle and not return journey of empty trailers

4.9 Sealing a 58km segment of the Plenty Highway

DESCRIPTION OF THE MODELLED SCENARIO

For this scenario, a 58 km segment of the road will be sealed and widened, and will accommodate the maximum state speed (Figure 4.9).

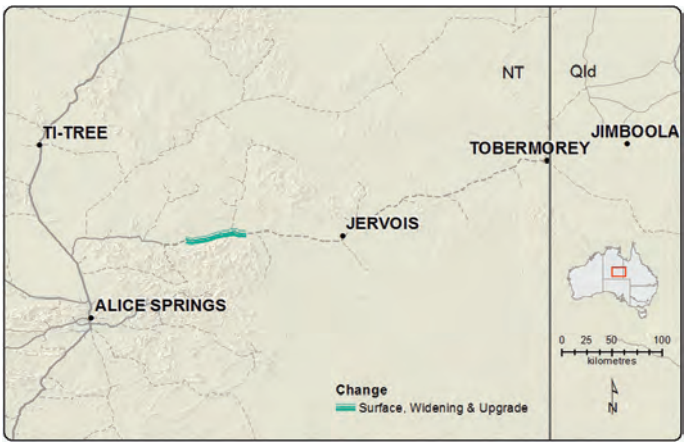

Figure 4.9: Segments of road on the Plenty highway to be upgraded

SUMMARY OF RESULTS

Table 4.9 summarises the cost savings per annum. Savings per annum for the modified parts of the road network are $19,191 for driving (i.e. when the vehicle is moving). Additional savings of $6,254 across the connecting road network are due to more vehicle trips using more efficient routes and/or configurations as a result of sealing these parts of the Plenty Highway.

TABLE 4.9: SUMMARY OF SAVINGS IF 58KM SEGMENT OF THE PLENTY HIGHWAY IS FULLY SEALED

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TRAILERS AFTER UPGRADE	SAVINGS PER HEAD
Travel	$19,191			
Vehicle break down	$0			
Broader network	$6,254			
Total	**$25,445**	**572**	**624**	**$1.26**

4.10 Widening and sealing of various road segments along the Buntine Highway

DESCRIPTION OF THE MODELLED SCENARIO

For this scenario, eight small (black spot) segments along the Buntine Highway between Montejinni and Camfield stations are widened and sealed, where the length of road sealed at each location is 1km (Figure 4.10).

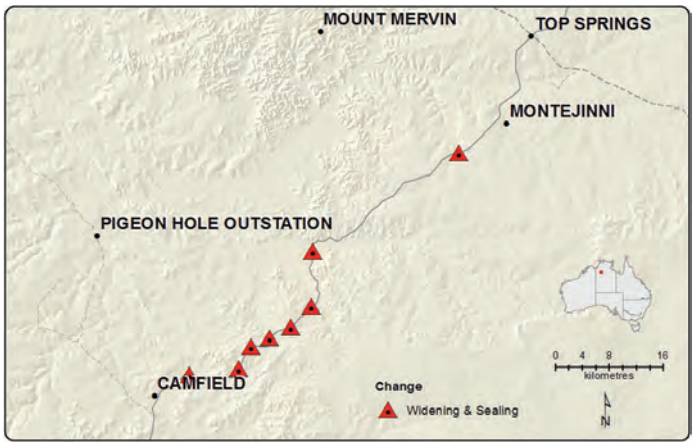

Figure 4.10: Location of 1km segments along the Buntine highway to be sealed and widened

SUMMARY OF SAVINGS

Table 4.10 summarises the cost savings per annum, based on full vehicles (single trailers). These savings include the costs associated with the return journey of empty trailers.

TABLE 4.10: SUMMARY OF SAVINGS IF A SELECTED 1KM SEGMENTS OF THE BUNTINE HIGHWAY IS SEALED/WIDENED

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TRAILERS AFTER UPGRADE	SAVINGS PER HEAD
Travel	$1,658			
Vehicle break down	$0			
Broader network	$2,950			
Total	**$4,608**	**632**	**632**	**$0.26**

5 Queensland Submissions

5.1 Upgrading to Type 2 access between Morven and Charleville

DESCRIPTION OF THE MODELLED SCENARIO

Part of the Warrego Highway between Charleville and Morven (Queensland) is currently classified as Type 1, with use restricted to Single Trailer, B-Double, and Type 1 vehicles only. In this scenario, this segment of road was upgraded to Type 2 vehicle access (Figure 5.1).

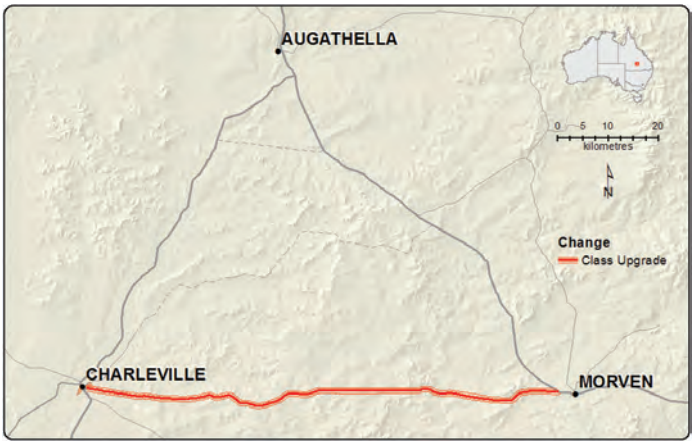

Figure 5.1: Segment of road between Morven and Charleville to be upgraded from Type 1 to Type 2

SUMMARY OF RESULTS

Table 5.1 summarises the cost savings per annum. Savings for the modified part of the road network are $248,905 for driving (i.e. when the vehicle is moving) and $7,826 for break down of vehicles into smaller configurations. Additional savings of $25,425 across the connecting road network are due to more vehicle trips using more efficient truck configurations and/or routes as a result of this upgrade. These savings include the costs associated with the return journey of empty trailers.

TABLE 5.1: SUMMARY OF SAVINGS IF CURRENT ROAD IS UPGRADED TO TYPE 2 ACCESS BETWEEN MORVEN AND CHARLEVILLE

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	SAVINGS PER HEAD
Travel	$248,905		
Vehicle break down	$7,826		
Broader network	$25,425		
Total	**$282,156**		**$2.69**

5.2 Upgrading to Type 1 access between Biloela and Gladstone

DESCRIPTION OF THE MODELLED SCENARIO

The roads between Biloela and Gladstone (Queensland) are currently classified as B-Double, with use restricted to Single Trailer and B-Double vehicles only. For this scenario, the segments of road classed as B-Double (Figure 5.2) were upgraded to allow passage by Type 1 vehicles.

Figure 5.2: Segments of road between Biloela and Gladstone upgraded from B-Double to Type 1

SUMMARY OF RESULTS

Table 5.2 summarises the cost savings per annum. Savings for the modified part of the road network are $67,162 for driving (i.e. when the vehicle is moving) and $12,457 for break down of vehicles in to smaller configurations. These savings include the costs associated with the return journey of empty trailers. Additional savings of $8,239 across the connecting road network are due to more vehicle trips using more efficient truck configurations and/or routes as a result of this upgrade.

TABLE 5.2: SUMMARY OF SAVINGS IF CURRENT ROAD IS UPGRADED TO TYPE 1 ACCESS BETWEEN BILOELA AND GLADSTONE

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	SAVINGS PER HEAD
Travel	$67,162		
Vehicle break down	$12,457		
Broader network	$8,239		
Total	**$87,858**	**920**	**$0.92**

5.3 Upgrading the bridge at Panorama Crossing

DESCRIPTION OF THE MODELLED SCENARIO

The bridge at Panorama Crossing is west of Rolleston on the Dawson highway (Figure 5.3). By improving the bridge, it would significantly reduce the frequency of the road being cut off by flooding and significant detours of vehicles.

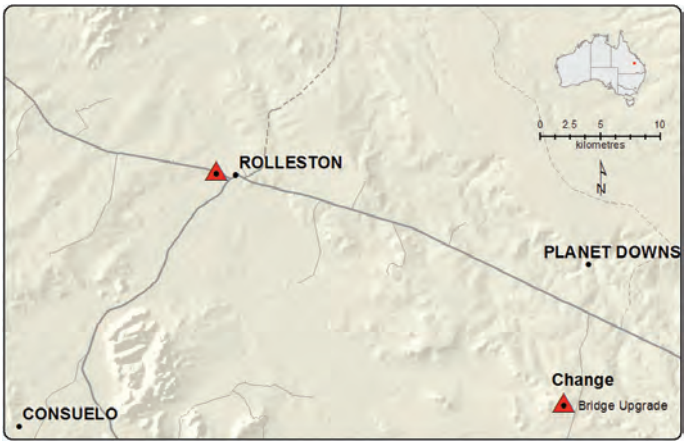

Figure 5.3: Location of bridge to be upgraded

SUMMARY OF RESULTS

To create Table 5.3, the total savings need to be interpreted differently to other scenarios. When testing the scenario where the road is blocked at Panorama Crossing, the $799,195 is the additional cost to cattle transport per year. A detour needs to be taken. The average cost per head of cattle for the detour is $1.22. Since the bridge at Panorama Crossing is flooded a small proportion of the year the $799,195 needs to be reduced to reflect the occasions the road is flooded. Data from the Queensland Government's Department of Transport and Main Roads indicated the Dawson Highway (Rolleston-Springsure) was cut 123 days during the six years between 2010 and 2015, or an average of 20.5 days per year. The value $799,195 is scaled back to reflect an average road closure of 20.5 out of 365 days.

TABLE 5.3: SUMMARY OF SAVINGS IF BRIDGE IS UPGRADED NEAR ROLLESTON, BASED ON BRIDGE FLOODED 20.5 DAYS PER YEAR

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	SAVINGS PER HEAD
Travel	$37,808		
Vehicle break down	$494		
Broader network	$6585		
Total	**$44,886**	**1524**	**$1.22**

5.4 Upgrading to Type 1 access on the Burnett Highway, between Leichhardt Highway and Biloela

Part of the Burnett Highway north of Biloela (Queensland) is currently classified as B-Double, with use restricted to Single Trailer and B-Double vehicles only. For this scenario, the segments of road classed as B-Double between Dululu and Biloela (Figure 5.4) were upgraded to Type 1 access.

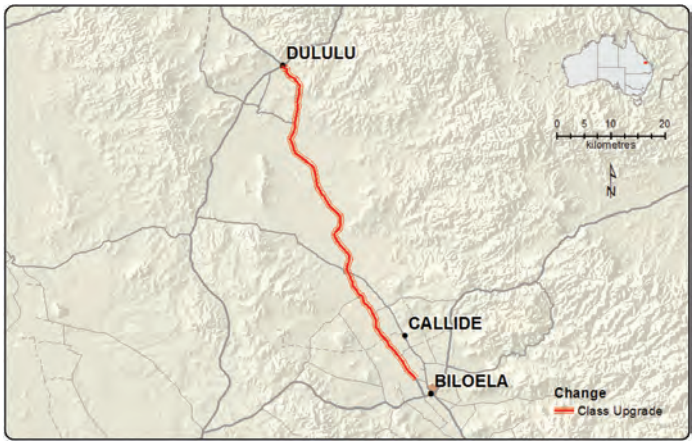

Figure 5.4: Segments of road between Dululu and Biloela to be upgraded from B-Double to Type 1

SUMMARY OF RESULTS

Table 5.4 summarises the cost savings per annum. Savings for the modified part of the road network are $73,910 for driving (i.e. when the vehicle is moving) and $79,582 for reduced decoupling of vehicles into smaller configurations. These savings include the costs associated with the return journey of empty trailers.

TABLE 5.4: SUMMARY OF SAVINGS IF CURRENT ROAD IS UPGRADED TO TYPE 1 ACCESS BETWEEN DULULU AND BILOELA

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TRAILERS AFTER UPGRADE	SAVINGS PER HEAD
Travel	$73,910			
Vehicle break down	$79,582			
Broader network	$65,198			
Total	**$218,689**	**3640**	**6088**	**$1.18**

5.5 Sealing unsealed sections of the Peninsula Developmental Road

DESCRIPTION OF THE MODELLED SCENARIO

About 400km of the Peninsula Developmental Road north of Laura (Queensland) are currently unsealed. For this scenario, these segments of road were sealed (Figure 5.5). Note some of the unsealed segments in this scenario already have approved funding.

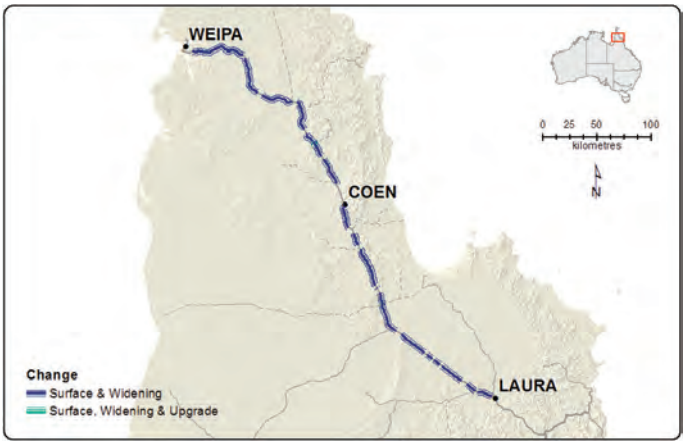

Figure 5.5: Segments of road north of Laura to be upgraded

SUMMARY OF RESULTS

Table 5.5 summarises the cost savings per annum determined, based on full vehicles (single trailers). Savings per annum for the modified parts of the road network are $18,194 for driving (i.e. when the vehicle is moving). Additional savings of $1,003 across the connecting road network are due to more vehicle trips using more efficient routes as a result of sealing these parts of the Peninsula Development Road. These savings include the costs associated with the return journey of empty trailers.

TABLE 5.5: SUMMARY OF SAVINGS IF CURRENT ROAD IS FULLY SEALED BETWEEN LAURA AND WEIPA. THESE RESULTS INCLUDE SEGMENTS PRE-APPROVED FOR FUNDING

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TRAILERS AFTER UPGRADE	SAVINGS PER HEAD
Travel	$18,194			
Vehicle break down	$247			
Broader network	$1,003			
Total	**$19,444**	**146**	**148**	**$1.44**

5.6 Widening the Savannah Way west of Doomadgee (to NT border)

DESCRIPTION OF THE MODELLED SCENARIO

The Savannah Way west of Doomadgee (Queensland) is currently sealed but single lane (half lane each way) to the NT border. The segments of road classed as sealed/single lane were widened to a two-lane sealed road, i.e. one lane each way (Figure 5.6).

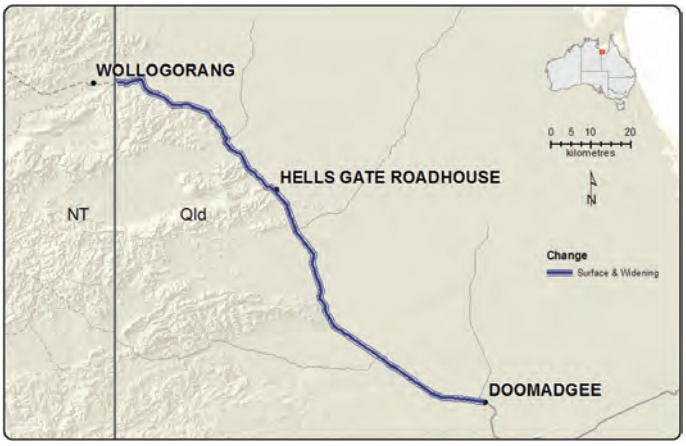

Figure 5.6: Segments of road west of Doomadgee to be upgraded

SUMMARY OF RESULTS

Table 5.6 summarises the cost savings per annum. Savings per annum for the modified parts of the road network are $27,401 for driving (i.e. when the vehicle is moving). The negative vehicle break down savings are due to some vehicle trips taking this route after the upgrade, where the savings of taking this outweigh the additional costs of decoupling. These savings include the costs associated with the return journey of empty trailers.

TABLE 5.6: SUMMARY OF SAVINGS IF SAVANNAH WAY WEST OF DOOMADGEE IS SEALED

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TRAILERS AFTER UPGRADE	SAVINGS PER HEAD
Travel	$27,401			
Vehicle break down	-$788			
Broader network	$11,269			
Total	**$37,882**	**914**	**962**	**$1.14**

5.7 Sealing unsealed sections of the Cloncurry to Dajarra Road

DESCRIPTION OF THE MODELLED SCENARIO

Parts of the Cloncurry to Dajarra Road (Queensland) are currently unsealed. The segments of road classed as unsealed were sealed (Figure 5.7).

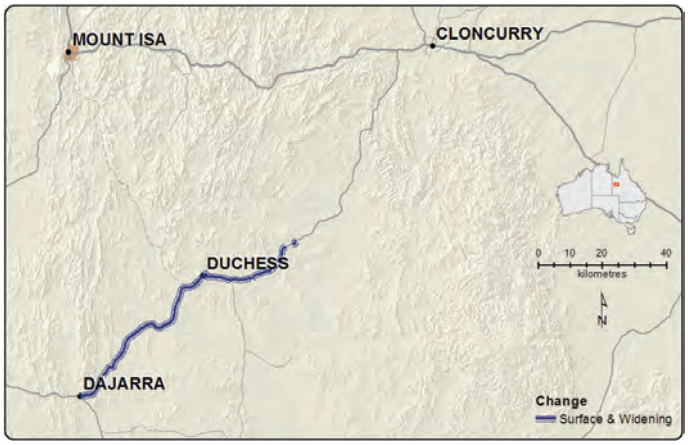

Figure 5.7: Segments of road between Cloncurry and Dajarra to be sealed

SUMMARY OF RESULTS

Table 5.7 summarises the cost savings per annum. These savings include the costs associated with the return journey of empty trailers. Figure 5.7a shows the impact of the Cloncurry to Dajarra upgrade on vehicle numbers (semi-trailer equivalents) across the network in that region. The blue numbers represent the number of trailers on the road segment before the upgrade and the red numbers after the upgrade. If the road is highlighted in blue, there is a net reduction in number of vehicles after the upgrade. If highlighted in red, there is a net increase in number of vehicles after the upgrade.

TABLE 5.7: SUMMARY OF ANNUAL SAVINGS IF CURRENT ROAD IS FULLY SEALED BETWEEN CLONCURRY AND DAJARRA

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TRAILERS AFTER UPGRADE	SAVINGS PER HEAD
Travel	$129,962			
Vehicle break down	$1,534			
Broader network	$43,291			
Total	**$174,788**	**886**	**4640**	**$1.15**

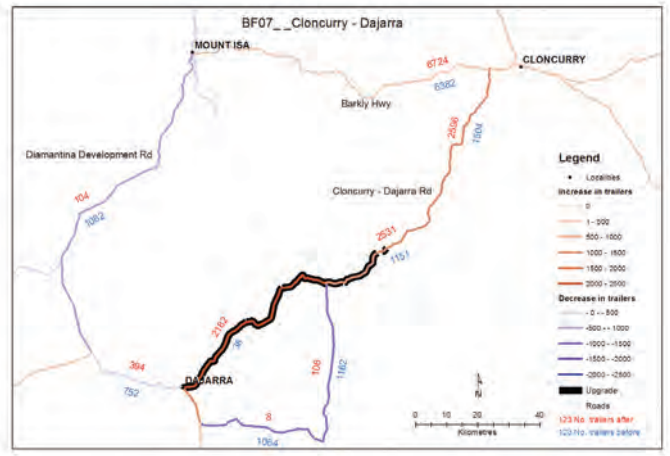

Figure 5.7a: Map of impact on freight flows. Trailer numbers (per annum) in the map are based on trips containing cattle and not the return journey of empty trailers

5.8 Sealing unsealed sections of the Hann Highway

DESCRIPTION OF THE MODELLED SCENARIO

Parts of the Hann Highway north of Hughenden (Queensland) are currently unsealed. For this scenario, segments of road classed as unsealed were sealed and other sections of the road were widened and a bridge upgraded (Figure 5.8).

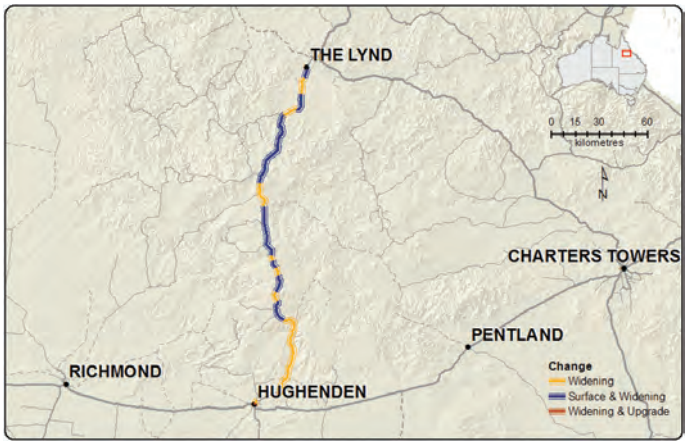

Figure 5.8: Segments of road north of Hughenden to be upgraded

SUMMARY OF RESULTS

Table 5.8 summarises the cost savings per annum. Savings per annum for the modified parts of the road network are $102,824 for driving (i.e. when the vehicle is moving) and $864 for break down of vehicles in to smaller configurations. Additional savings of $58,438 across the connecting road network are due to more vehicle trips using more efficient truck configurations and/or routes as a result of this upgrade. These savings include the costs associated with the return journey of empty trailers.

TABLE 5.8: SUMMARY OF SAVINGS IF CURRENT ROAD IS FULLY SEALED BETWEEN THE LYND AND HUGHENDEN

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TRAILERS AFTER UPGRADE	SAVINGS PER HEAD
Travel	$102,824			
Vehicle break down	$864			
Broader network	$58,438			
Total	**$162,126**	**2038**	**2786**	**$1.30**

5.9 Sealing unsealed sections of the Wills Developmental Road between Julia Creek and the Burke and Wills Roadhouse

DESCRIPTION OF THE MODELLED SCENARIO

Parts of the Wills Developmental Road between Julia Creek and the Burke and Wills Roadhouse are currently unsealed and are proposed to be sealed (Figure 5.9).

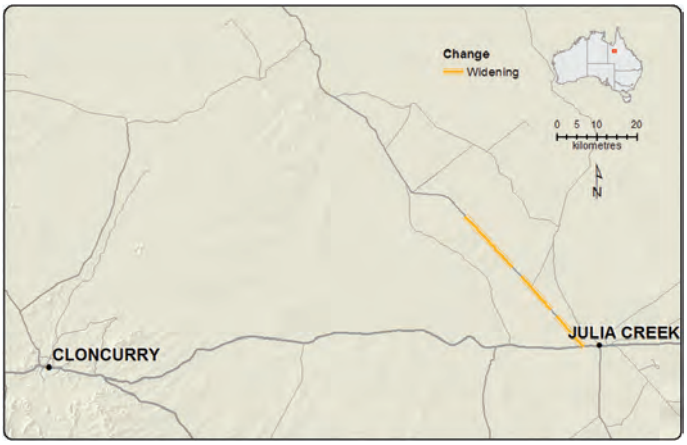

Figure 5.9: Segments of road north of Julia Creek to be upgraded

SUMMARY OF RESULTS

Table 5.9 summarises the cost savings per annum. Savings per annum for the modified parts of the road network are $31,350 for driving (i.e. when the vehicle is moving) and additional savings of $14,337 across the connecting road network are due to more vehicle trips using more efficient truck configurations and/or routes as a result of this upgrade. The negative vehicle break down savings are due to some vehicle trips taking this route after the upgrade, where the savings of taking this outweigh the additional costs of decoupling. These savings include the costs associated with the return journey of empty trailers.

TABLE 5.9: SUMMARY OF SAVINGS IF SEALING SEGMENTS OF ROAD NORTH OF JULIA CREEK

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TRAILERS AFTER UPGRADE	SAVINGS PER HEAD
Travel	$31,350			
Vehicle break down	-$868			
Broader network	$14,337			
Total	**$44,819**	**460**	**1158**	**$0.60**

5.10 Sealing segments of the Rolleston to Suttor Developmental Road

DESCRIPTION OF THE MODELLED SCENARIO

This scenario involved the sealing of various segments of the road between Rolleston and Suttor, plus some productivity vehicle modifications (e.g. B-Double to Type 1) north of the Capricorn Highway (Figure 5.10).

Figure 5.10: Segments of the road between Rolleston and Suttor to be upgraded

SUMMARY OF RESULTS

Table 5.10 summarises the cost savings per annum. These savings include the costs associated with the return journey of empty trailers. The total annual savings are $120,617 or $0.92 per head. The negative vehicle break down savings are due to some vehicle trips taking this route after the upgrade, where the savings of taking this outweigh the additional costs of decoupling.

TABLE 5.10: SUMMARY OF SAVINGS FROM SEALING VARIOUS SEGMENTS BETWEEN ROLLESTON AND SUTTOR

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TRAILERS AFTER UPGRADE	SAVINGS PER HEAD
Travel	$123,669			
Vehicle break down	-$14,467			
Broader network	$11,714			
Total	**$120,617**	**458**	**856**	**$0.92**

5.11 Sealing unsealed sections of the Clermont to Alpha Road

DESCRIPTION OF THE MODELLED SCENARIO

Parts of the Clermont to Alpha Road (Queensland) are currently unsealed. For the scenario, these segments of road were sealed (Figure 5.11).

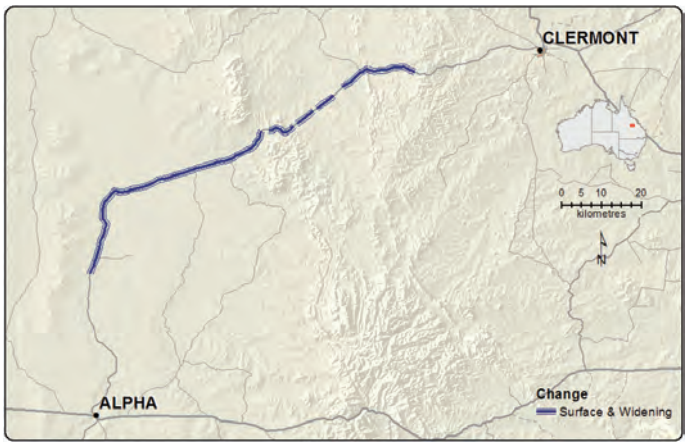

Figure 5.11: Segments of road between Clermont and Alpha to be upgraded

SUMMARY OF RESULTS

Table 5.11 summarises the cost savings per annum. Savings per annum for the modified parts of the road network are $169,512 for driving (i.e. when the vehicle is moving) and $31,536 for break down of vehicles in to smaller configurations. Additional savings of $59,282 across the connecting road network are due to more vehicle trips using more efficient routes and/or configurations as a result of sealing these parts of the Clermont to Alpha Road. These savings include the costs associated with the return journey of empty trailers.

TABLE 5.11: SUMMARY OF SAVINGS IF CURRENT ROAD IS FULLY SEALED BETWEEN ALPHA AND CLERMONT

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TRAILERS AFTER UPGRADE	SAVINGS PER HEAD
Travel	$169,512			
Vehicle break down	$31,536			
Broader network	$59,282			
Total	**$260,329**	**526**	**3312**	**$2.49**

5.12 Upgrading to B-Double access on the Eidsvold to Theodore Road

The Eidsvold to Theodore Road (Queensland) is currently classified as Single Trailer, with use restricted to single trailer vehicles only. For this scenario, these segments were upgraded to B-Double access (Figure 5.12).

Figure 5.12: Segments of road between Eidsvold and Theodore upgraded from Single Trailer to B-Double

SUMMARY OF RESULTS

Table 5.12 summarises the cost savings per annum. Savings for the modified part of the road network are $79,852 for driving (i.e. when the vehicle is moving) and losses of $7,768 occur for break down of vehicles in to smaller configurations. Additional savings of $7,051 across the connecting road network are due to the increased number of vehicle trips choosing more efficient routings and/or truck configurations due to this road network upgrade. After the road upgrade, there would be a significant increase in vehicle trips, as there would be much fewer detours.

TABLE 5.12: SUMMARY OF SAVINGS IF CURRENT ROAD IS UPGRADED TO B-DOUBLE ACCESS BETWEEN THEODORE AND EIDSVOLD

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TRAILERS AFTER UPGRADE	SAVINGS PER HEAD
Travel	$79,852			
Vehicle break down	$7,768			
Broader network	$7,051			
Total	**$94,671**	**260**	**1726**	**1.41**

5.13 Sealing sections of the Cloncurry to Phosphate Road

DESCRIPTION OF THE MODELLED SCENARIO

Parts of the road between Cloncurry and Phosphate (Queensland) are currently unsealed. For this scenario, these segments of road were sealed and widened, and an existing sealed section was widened and a bridge upgraded (Figure 5.13).

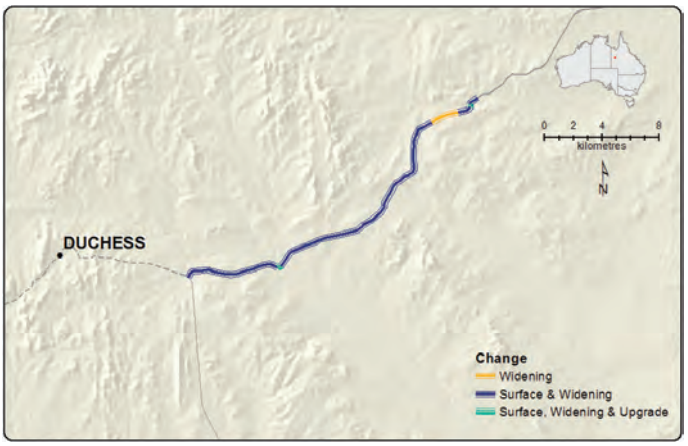

Figure 5.13: Segments of road between Phosphate and Cloncurry to be upgraded

SUMMARY OF RESULTS

Table 5.13 summarises the cost savings per annum. Savings per annum for the modified parts of the road network are $28,233 for driving (i.e. when the vehicle is moving). Additional savings of $21,179 across the connecting road network are due to more vehicle trips using more efficient routes and/or configurations as a result of sealing these parts of the Cloncurry to Phosphate Road. These savings include the costs associated with the return journey of empty trailers.

TABLE 5.13: SUMMARY OF SAVINGS FOR UPGRADING ROAD BETWEEN PHOSPHATE AND CLONCURRY

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TRAILERS AFTER UPGRADE	SAVINGS PER HEAD
Travel	$28,233			
Vehicle break down	$3,342			
Broader network	$21,179			
Total	**$52,754**	**3008**	**3540**	**$0.52**

5.14 Sealing unsealed sections of the Richmond to Croydon Road

DESCRIPTION OF THE MODELLED SCENARIO

Parts of the Richmond to Croydon Road (Queensland) are currently unsealed. For this scenario, the segments of road classed as unsealed were sealed (Figure 5.14).

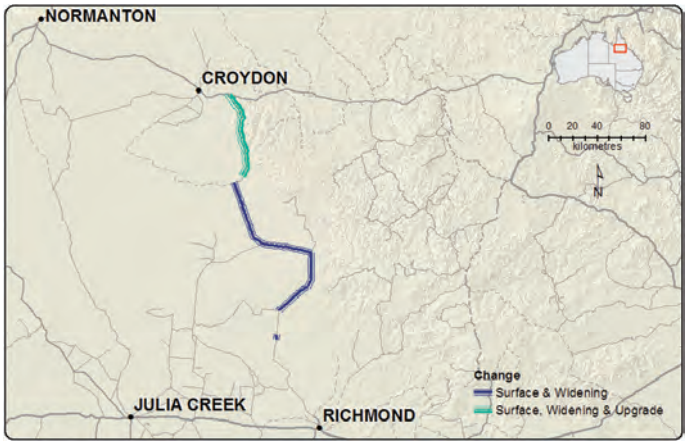

Figure 5.14: Segments of road between Richmond and Croydon to be upgraded

SUMMARY OF RESULTS

Table 5.14 summarises the cost savings per annum. Savings per annum for the modified parts of the road network are $258,601 for driving (i.e. when the vehicle is moving). Additional savings of $45,475 across the connecting road network are due to more vehicle trips using more efficient routes and/or configurations as a result of sealing these parts of the highway. These savings include the costs associated with the return journey of empty trailers.

TABLE 5.14: SUMMARY OF SAVINGS IF ROAD IS FULLY SEALED BETWEEN RICHMOND AND CROYDON

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TRAILERS AFTER UPGRADE	SAVINGS PER HEAD
Travel	$258,601			
Vehicle break down	$1,888			
Broader network	$45,475			
Total	**$305,964**	**886**	**2236**	**$3.24**

5.15 Upgrading to Type 1 access between Gracemere and Rockhampton Abattoirs

DESCRIPTION OF THE MODELLED SCENARIO

Roads between Gracemere and Rockhampton plus part of the Rockhampton to Emu Park access road to the east of the port are currently classified as B-Double, with use restricted to single and B-Double vehicles only. For this scenario, these segments of road were upgraded to Type 1 access (Figure 5.15). Most of the 20,532 trailers travelling along the road (including return of empty trailers) per year are transported to either of the two meatworks at Rockhampton, whilst the others use part of the road segment enroute to other enterprises.

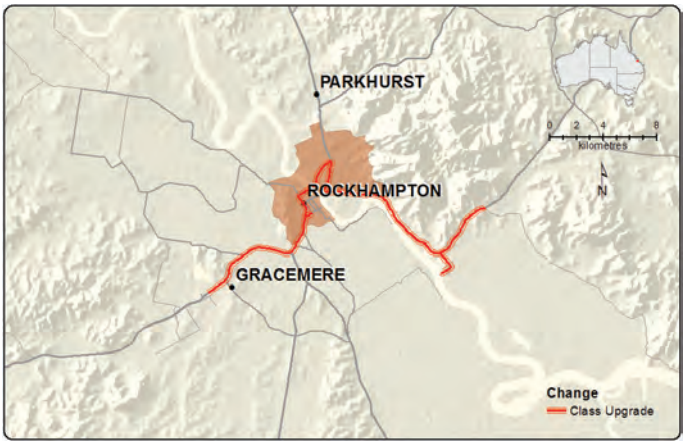

Figure 5.15: Segments of road between Gracemere and Rockhampton and east of the port upgraded to Type 1

SUMMARY OF RESULTS

Table 5.15 summarises the cost savings per annum. These savings include the costs associated with the return journey of empty trailers.

TABLE 5.15: SUMMARY OF SAVINGS IF CURRENT ROAD IS UPGRADED TO TYPE 1 ACCESS BETWEEN GRACEMERE AND ROCKHAMPTON

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TRAILERS AFTER UPGRADE	SAVINGS PER HEAD
Travel	$198,296			
Vehicle break down	$374,995			
Broader network	$165,628			
Total	**$738,919**	**20532**	**22668**	**$1.63**

5.16 Upgrading the Gregory Developmental Road to Type 2 between Clermont and Emerald

DESCRIPTION OF THE MODELLED SCENARIO

The Gregory Developmental Road between Clermont and Emerald (Queensland) is currently classed as Type 1, allowing access to Single Trailer, B-double and Type 1 vehicles. For this scenario, the segments of road classed as Type 1 were upgraded to Type 2 access (Figure 5.16).

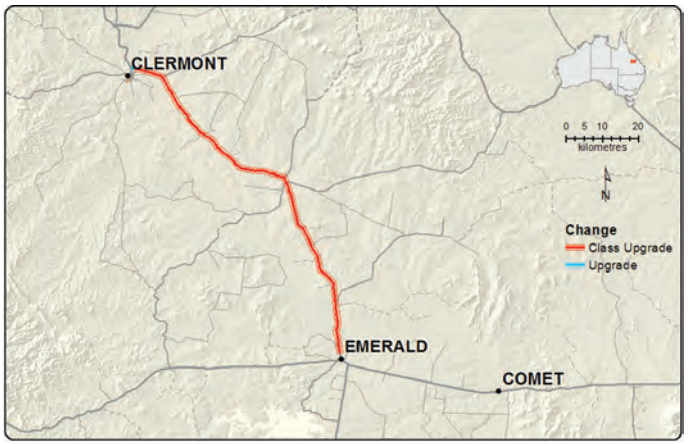

Figure 5.16: Segments of the Gregory Developmental Road between Clermont and Emerald upgraded

SUMMARY OF RESULTS

Table 5.16 summarises the cost savings per annum, based on full vehicles (single trailers). Savings per annum for the modified parts of the road network are $282,739 for driving (i.e. when the vehicle is moving). Additional savings of $168,609 across the connecting road network are due to more vehicle trips using more efficient routes and/or configurations as a result of sealing these parts of the Gregory Developmental Road. These savings include the costs associated with the return journey of empty trailers. Figure 5.16a shows the impact of the Clermont to Emerald upgrade on vehicle numbers (semi-trailer equivalents carrying cattle) across the network in that region. The blue numbers represent the number of trailers (with cattle) on the road segment before the upgrade and the red numbers after the upgrade. If the road is highlighted in blue, there is a net reduction in number of vehicles after the upgrade. If highlighted in red, there is a net increase in number of vehicles after the upgrade.

TABLE 5.16: SUMMARY OF SAVINGS IF GREGORY DEVELOPMENTAL ROAD BETWEEN CLERMONT AND EMERALD IS UPGRADED TO TYPE 2

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TRAILERS AFTER UPGRADE	SAVINGS PER HEAD
Travel	$282,739			
Vehicle break down	$14,864			
Broader network	$168,609			
Total	**$466,213**	**10544**	**12933**	**$1.10**

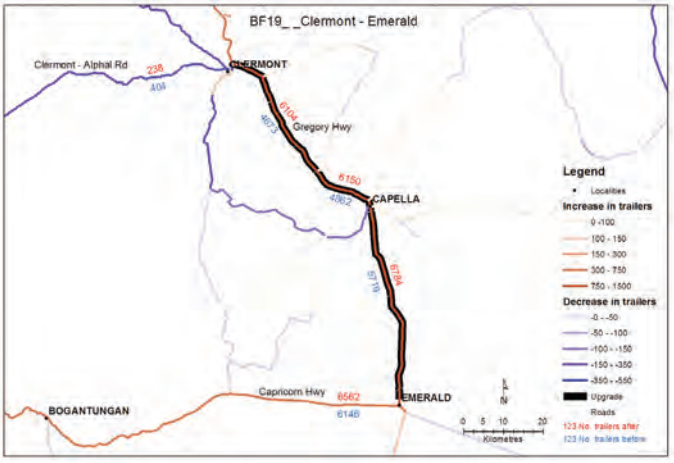

Figure 5.16a: Map of impact on freight flows. Trailer numbers (per annum) in the map are based on trips containing cattle and not return journey of empty trailers

5.17 Upgrading the Dingo Park Road intersection to the DAVCO feedlot

DESCRIPTION OF THE MODELLED SCENARIO

The Dingo Park Road is currently limited to semi trailer access. This scenario will provide Type 2 vehicle access to the feedlot.

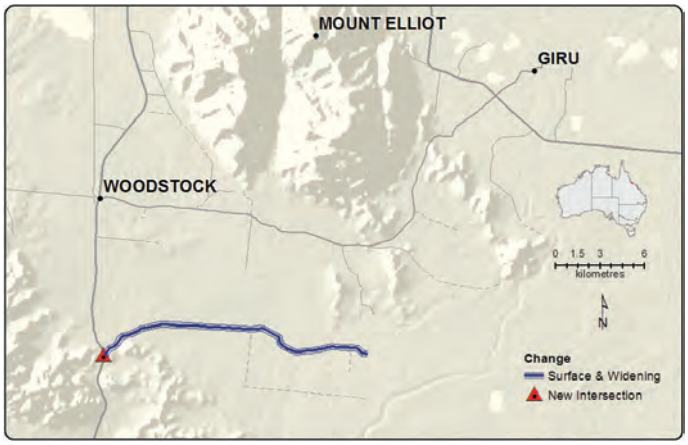

Figure 5.17: Dingo Park Road intersection near DAVCO feedlot upgraded

SUMMARY OF RESULTS

The savings in Table 5.17 are based on vehicles per year from 2008 to 2013. If the feedlot was utilised to current 10,000 animal capacity (334 Trailers including return journey) the annual savings would be $16,300 plus additional savings for cattle transported to the feedlot rather than longer distances to alternative feedlots. For a DAVCO future scenario of 42,000 head per year (1400 Trailers including return journey), annual savings would be $68,460. Reduced transport travel resulting from expanded feedlot (i.e. cattle redistributed from other feedlots) throughput are outside of the beef roads.

TABLE 5.17: SUMMARY OF SAVINGS IF UPGRADE OF DINGO PARK ROAD INTERSECTION TO DAVCO FEEDLOT

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	SAVINGS PER HEAD	SAVINGS AT 42000 HEAD SCENARIO
Travel	$0			
Vehicle break down	$3754			
Broader network	$2492			
Total	**$6246**	**128**	**$1.63**	**$68,460**

5.18 Sealing part of the Outback Highway between Boulia and Tobermorey Road

DESCRIPTION OF THE MODELLED SCENARIO

The Outback Highway between Boulia (Queensland) and Tobermorey Road (NT) is currently unsealed. For this scenario, the segments of road classed as unsealed were sealed (Figure 5.18).

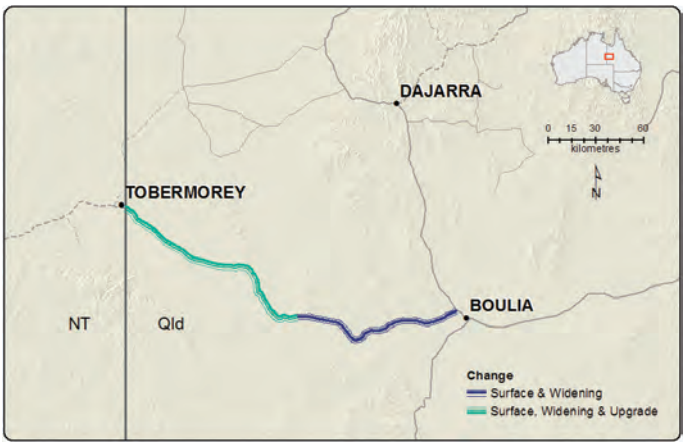

Figure 5.18: Segments of the road between Boulia and Tobermorey Road upgraded

SUMMARY OF RESULTS

Table 5.18 summarises the cost savings per annum, based on full vehicles (single trailers). Savings per annum for the modified parts of the road network are $105,125 for driving (i.e. when the vehicle is moving). Additional savings of $27,276 across the connecting road network are due to more vehicle trips using more efficient routes and/or configurations as a result of sealing this section of the Outback Highway. These savings include the costs associated with the return journey of empty trailers.

TABLE 5.18: SUMMARY OF SAVINGS IF SEALING OF PART OF OUTBACK HIGHWAY BETWEEN BOULIA AND TOBERMOREY ROAD

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TRAILERS AFTER UPGRADE	SAVINGS PER HEAD
Travel	$105,125			
Vehicle break down	$156			
Broader network	$27,276			
Total	**$132,557**	**378**	**787**	**$2.61**

5.19 Sealing unsealed sections of the Burke Developmental Road between Mareeba and Normanton

DESCRIPTION OF THE MODELLED SCENARIO

Parts of the Burke Developmental Road between Mareeba and Normanton (Queensland) are currently unsealed. For this scenario, some segments of road classed as unsealed were sealed (Figure 5.19).

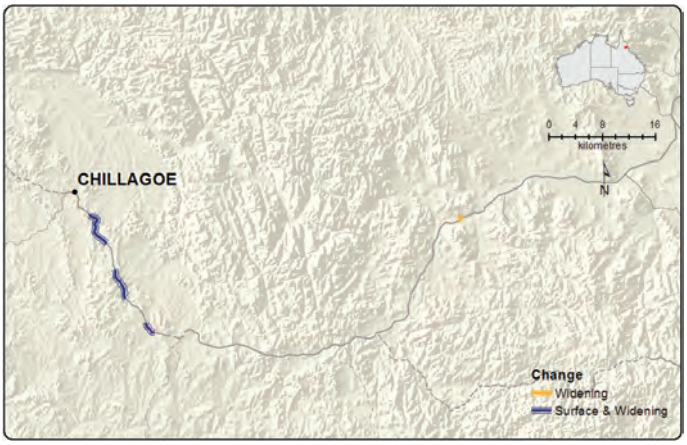

Figure 5.19: Segments of road between Mareeba and Normanton upgraded

SUMMARY OF RESULTS

Table 5.19 summarises the cost savings per annum. Savings per annum for the modified parts of the road network are $3,137 for driving (i.e. when the vehicle is moving). These savings include the costs associated with the return journey of empty trailers. The negative vehicle break down savings are due to some vehicle trips taking this route after the upgrade, where the savings of taking this outweigh the additional costs of decoupling.

TABLE 5.19: SUMMARY OF SAVINGS IF SECTIONS OF BURKE DEVELOPMENTAL ROAD ARE SEALED BETWEEN MAREEBA AND NORMANTON

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	SAVINGS PER HEAD
Travel	$3,137		
Vehicle break down	-$788		
Broader network	$0		
Total	**$2,350**	**142**	**$0.35**

5.20 Widening sections of the Burke Developmental Road between Cloncurry and Normanton

DESCRIPTION OF THE MODELLED SCENARIO

Parts of the Burke Developmental Road between Cloncurry and Normanton (Queensland) are currently classified single lane. For this scenario, the segments of road classed as single lane (Figure 5.20) were upgraded to single lane both ways.

Figure 5.20: Segments of road between Normanton and Cloncurry upgraded to single lane both ways

SUMMARY OF RESULTS

Table 5.20 summarises the cost savings per annum. Savings for the modified part of the road network are $11,689 for driving (i.e. when the vehicle is moving). Additional savings of $20,400 across the connecting road network are due to more vehicle trips using more efficient routes and/or configurations as a result of widening these parts of the Burke Developmental Road. These savings include the costs associated with the return journey of empty trailers.

TABLE 5.20: SUMMARY OF SAVINGS IF CURRENT ROAD IS UPGRADED TO SINGLE LANE BOTH WAYS BETWEEN NORMANTON AND CLONCURRY

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TRAILERS AFTER UPGRADE	SAVINGS PER HEAD
Travel	$11,689			
Vehicle break down	$156			
Broader network	$20,400			
Total	**$32,244**	**3420**	**3835**	**$0.23**

5.21 Widening sections of the Gulf Developmental Road between Mt Garnet and Normanton Road

DESCRIPTION OF THE MODELLED SCENARIO

Parts of the Gulf Developmental Road between Mt Garnet and Normanton (Queensland) are currently not single lane each way. For this scenario, the segments of road not classed as single lane each way (Figure 5.21) were upgraded to single lane both ways.

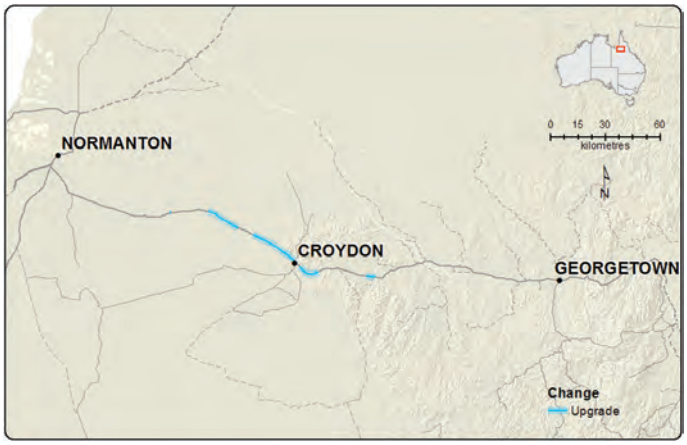

Figure 5.21: Segments of road between Normanton and Mt Garnet upgraded to single lane both ways

SUMMARY OF RESULTS

Table 5.21 summarises the cost savings per annum. These savings include the costs associated with the return journey of empty trailers. Savings are significantly lower than for the Burke Development Road since the roads segments being upgraded are a higher standard.

TABLE 5.21: SUMMARY OF SAVINGS IF CURRENT ROAD IS UPGRADED TO SINGLE LANE BOTH WAYS, NORMANTON TO MT GARNET

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	SAVINGS PER HEAD
Travel	$2,232		
Vehicle break down	-$788		
Broader network	$0		
Total	**$1,444**	**2501**	**$0.01**

5.22 Sealing unsealed sections of the Mt Garnet to Winton Road, and upgrading to Type 2 access

DESCRIPTION OF THE MODELLED SCENARIO

Parts of the Mt Garnet to Winton Road (Queensland) are unsealed and/or Type 1, restricting access to Single Trailer, B-Double and Type 1 vehicles only. For this scenario, these sections of road (Figure 5.22) were upgraded so that all sections were sealed and allowed Type 2 access. Whilst this scenario has some overlap with the Hann Highway scenario, not all segments are to be sealed.

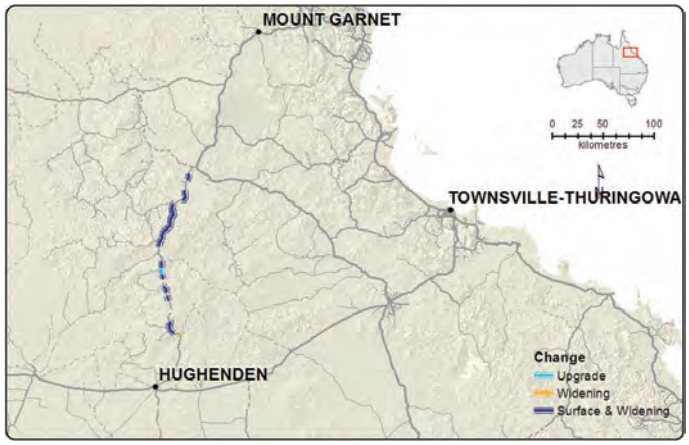

Figure 5.22: Segments of road between Mt Garnet and Winton upgraded. Note the segments being upgraded are north of Hughenden

SUMMARY OF RESULTS

Table 5.22 summarises the cost savings per annum. These savings include the costs associated with the return journey of empty trailers.

TABLE 5.22: SUMMARY OF SAVINGS IF CURRENT ROAD BETWEEN WINTON TO MT GARNET IS UPGRADED

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TRAILERS AFTER UPGRADE	SAVINGS PER HEAD
Travel	$44,239			
Vehicle break down	$156			
Broader network	$34,675			
Total	**$79,070**	**1788**	**2432**	**$0.76**

5.23 Sealing unsealed sections of the Burketown to Julia Creek Road and input of a new road segment

DESCRIPTION OF THE MODELLED SCENARIO

Parts of the Burketown to Julia Creek Road (Queensland) via Gregory Downs are unsealed. For this scenario, these sections of road (Figure 5.23) were sealed and a new segment added.

Figure 5.23: Segments of road between Burketown and Julia Creek upgraded or added

SUMMARY OF RESULTS

Table 5.23 summarises the cost savings per annum. Savings for the modified part of the road network are $95,265 for driving (i.e. when the vehicle is moving). Additional savings of $23,187 across the connecting road network are due to more vehicle trips using more efficient routes and/or configurations as a result of widening these parts of the Gulf Developmental Road. These savings include the costs associated with the return journey of empty trailers.

An additional feature of this scenario was the impact of Bailey Bridge being impassable due to flooding. The model showed this would cost an extra $9.77 per head in transport costs from detours or an average of $1250 per day that the bridge is impassable.

TABLE 5.23: SUMMARY OF SAVINGS IF ROAD BETWEEN BURKETOWN AND JULIA CREEK IS SEALED AND NEW ROAD SEGMENT ADDED

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TRAILERS AFTER UPGRADE	SAVINGS PER HEAD
Travel	$95,265			
Vehicle break down	$0			
Broader network	$23,187			
Total	**$118,452**	**2194**	**2930**	**$0.53**

5.24 Sealing and widening sections of the Bedourie to Winton Road

DESCRIPTION OF THE MODELLED SCENARIO

This scenario involves widening and sealing several small segments of the road between Bedourie and Winton as per Figure 5.24. It will allow for better linkages for road trains.

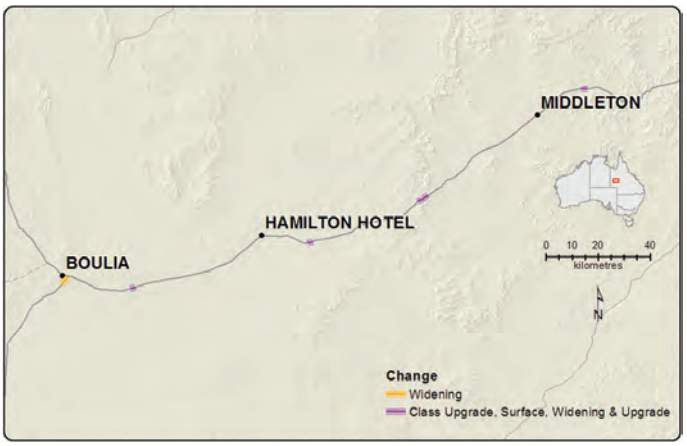

Figure 5.24: Segments of road being sealed or widened for Bedourie to Winton Road

SUMMARY OF RESULTS

Table 5.24 summarises the cost savings per annum, based on full vehicles (single trailers). These savings include the costs associated with the return journey of empty trailers.

TABLE 5.24: SUMMARY OF SAVINGS FOR SEGMENTS OF ROAD BEING SEALED OR WIDENED FOR BEDOURIE TO WINTON ROAD

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TRAILERS AFTER UPGRADE	SAVINGS PER HEAD
Travel	$7,896			
Vehicle break down	$0			
Broader network	$708			
Total	**$8,604**	**563**	**1756**	**$0.06**

5.25 Sealing unsealed sections of the Mt Isa to Boulia Road

DESCRIPTION OF THE MODELLED SCENARIO

Parts of the Mt Isa to Boulia Road (Queensland) are unsealed. For this scenario, these sections of road (Figure 5.25) were sealed.

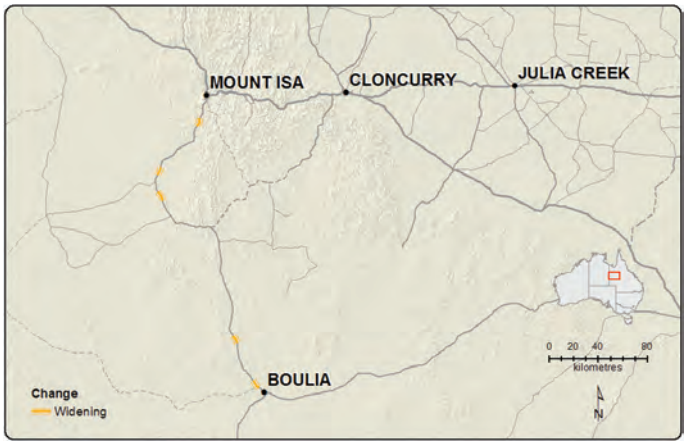

Figure 5.25: Segments of road between Mount Isa and Boulia sealed

SUMMARY OF RESULTS

Table 5.25 summarises the cost savings per annum. Savings for the modified part of the road network are $46,640 for driving (i.e. when the vehicle is moving). These savings include the costs associated with the return journey of empty trailers.

TABLE 5.25: SUMMARY OF SAVINGS IF CURRENT ROAD IS SEALED BETWEEN MT ISA AND BOULIA

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TRAILERS AFTER UPGRADE	SAVINGS PER HEAD
Travel	$46,640			
Vehicle break down	$0			
Broader network	$14,809			
Total	**$61,449**	**2560**	**2682**	**$0.39**

5.26 Sealing unsealed roads, widening and upgrading various segments between Mt Surprise and Emerald

DESCRIPTION OF THE MODELLED SCENARIO

This scenario involves sealing and sealing various segments between Mt Surprise and Emerald as per Figure 5.26.

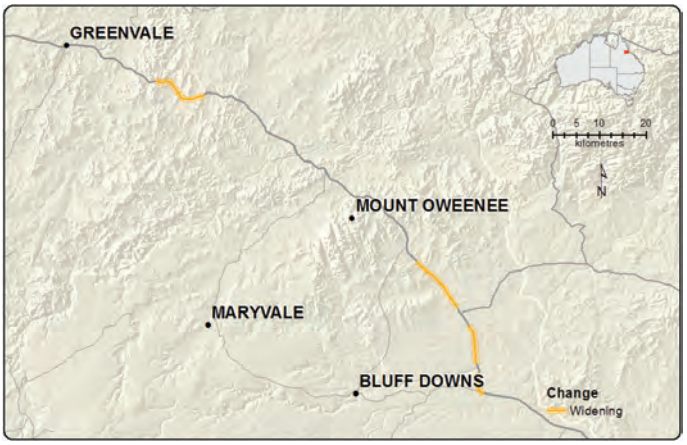

Figure 5.26: Location of the segments of road being widened between Mt Surprise and Emerald

SUMMARY OF RESULTS

Table 5.26 summarises the cost savings per annum, based on full vehicles (single trailers). The negative vehicle break down savings are due to some vehicle trips taking this route after the upgrade, where the savings of taking this outweigh the additional costs of decoupling.

TABLE 5.26: SUMMARY OF SAVINGS IF WIDENING AND SEALING OF UNSEALED ROADS, WIDENING AND UPGRADE BETWEEN MT SURPRISE AND EMERALD IS WIDENED AND BRIDGES UPGRADES AS PER SCENARIO

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TRAILERS AFTER UPGRADE	SAVINGS PER HEAD
Travel	$62,138			
Vehicle break down	-$4,261			
Broader network	$11,878			
Total	**$69,755**	**2840**	**3299**	**$0.72**

5.27 Road widening and upgrading bridges on the Dingo to Mt Flora Road

DESCRIPTION OF THE MODELLED SCENARIO

This scenario involves several upgrades including upgrading of bridges, widening and replacing of culverts, and widening of road segments. Location of road segments being widened are shown in Figure 5.27.

Figure 5.27: Location of road widening between Dingo and Mt Flora

SUMMARY OF RESULTS

Table 5.27 summarises the cost savings per annum, based on full vehicles (single trailers). The negative vehicle break down savings are due to some vehicle trips taking this route after the upgrade, where the savings of taking this outweigh the additional costs of decoupling.

TABLE 5.27: SUMMARY OF SAVINGS IF CURRENT ROAD IS WIDENED AND BRIDGES UPGRADES AS PER SCENARIO

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TRAILERS AFTER UPGRADE	SAVINGS PER HEAD
Travel	$14,062			
Vehicle break down	-$3,319			
Broader network	$560			
Total	**$11,303**	**2450**	**2682**	**$0.07**

5.28 Sealing unsealed sections of the Collinsville to Belyando Crossing Road

This scenario looks at the impact of sealing of unsealed sections of the Collinsville to Belyando Crossing Road (Figure 5.28). The breakdown pad was not included in the scenario.

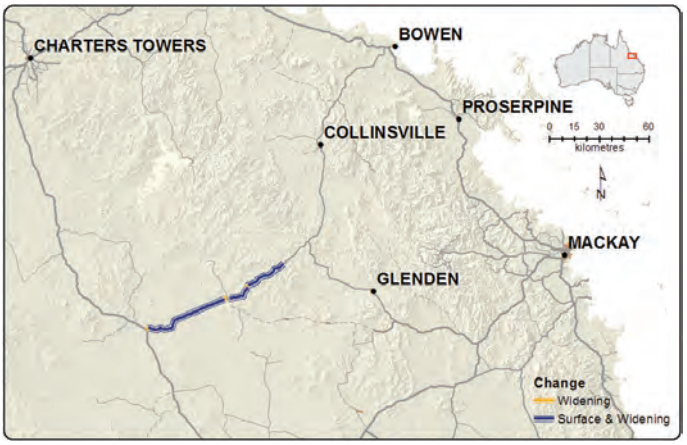

Figure 5.28: Locations of unsealed sections of the Collinsville to Belyando Crossing Road to be sealed

SUMMARY OF RESULTS

Figure 5.28a shows the impact of the Collinsville to Belyando upgrade on vehicle numbers across the network in that region. The blue numbers represent the number of trailers (with cattle) on the road segment before the upgrade and the red numbers after the upgrade. If the road is highlighted in blue, there is a net reduction in number of vehicles after the upgrade. If highlighted in red, there is a net increase in number of vehicles after the upgrade. In this case there were almost three times as many vehicles using the road after the upgrade.

TABLE 5.28: SUMMARY OF ANNUAL SAVINGS BY SEALING UNSEALED SECTIONS OF COLLINSVILLE TO BELYANDO CROSSING ROAD

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TRAILERS AFTER UPGRADE	SAVINGS PER HEAD
Travel	$82,342			
Vehicle break down	$2,721			
Broader network	$12,889			
Total	**$97,953**	**300**	**1064**	**$3.16**

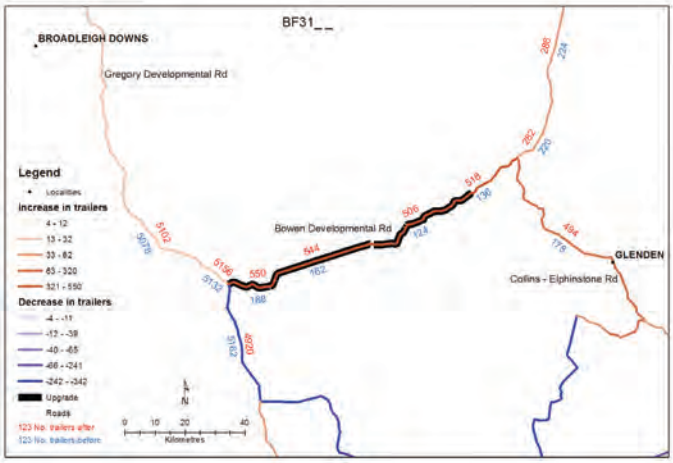

Figure 5.28a: Map of impact on freight flows. Trailer numbers (per annum) in the map are based on trips containing cattle and not return journey of empty trailers

5.29 Sealing unsealed sections of the Torrens Creek to Aramac Road

DESCRIPTION OF THE MODELLED SCENARIO

Parts of the Torrens Creek to Aramac Road (Queensland) are unsealed. For this scenario, these sections of road (Figure 5.29) were sealed.

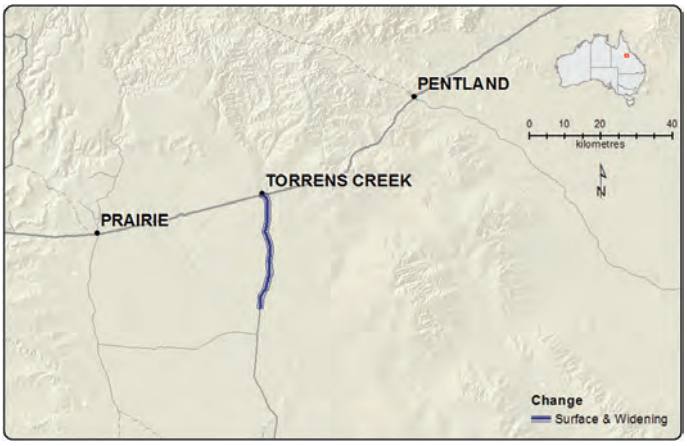

Figure 5.29: Segments of the road between Torrens Creek and Aramac sealed

SUMMARY OF RESULTS

Table 5.29 summarises the cost savings per annum, based on full vehicles (single trailers). Savings for the modified part of the road network are $45,689 for driving (i.e. when the vehicle is moving). These savings include the costs associated with the return journey of empty trailers. Savings across the connecting road network of $6,924 are due to more vehicle trips using more efficient routes and/or configurations as a result of sealing these parts of the Torrens Creek to Aramac Road.

TABLE 5.29: SUMMARY OF SAVINGS IF ROAD BETWEEN TORRENS CREEK AND ARAMAC ROAD IS FULLY SEALED

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TRAILERS AFTER UPGRADE	SAVINGS PER HEAD
Travel	$45,689			
Vehicle break down	$0			
Broader network	$6,924			
Total	**$52,613**	**1160**	**1936**	**$0.96**

5.30 Partial Mareeba bypass, linking the Mulligan Highway to the Burke Developmental Road

DESCRIPTION OF THE MODELLED SCENARIO

For this scenario, a new bypass road was created to the north-west of Mareeba, to link the Mulligan Highway to the Burke Developmental Road (Figure 5.30).

Figure 5.30: Segments of road created north-west of Mareeba to link the Mulligan Highway to the Burke Developmental road

SUMMARY OF RESULTS

Table 5.30 summarises the cost savings per annum, based on full vehicles (single trailers). These savings include the costs associated with the return journey of empty trailers.

TABLE 5.30: SUMMARY OF SAVINGS IF PARTIAL MAREEBA BYPASS IS CREATED TO LINK THE MULLIGAN HIGHWAY WITH THE BURKE DEVELOPMENTAL ROAD

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TRAILERS AFTER UPGRADE	SAVINGS PER HEAD
Travel	$4.388			
Vehicle break down	$0			
Broader network	$0			
Total	**$4,388**	**1080**	**1124**	**$0.15**

5.31 Upgrading to allow Type 2 access to the JBS Swift Australia Meat Works, Stuart

DESCRIPTION OF THE MODELLED SCENARIO

Cattle transported from Western Queensland to Townsville in Type 2 Road Trains currently only have Type 2 access along the Bruce Highway under permit. The scenario assumes an upgrade from B-Double access to Type 2 (Figure 5.31). This upgrade would require the construction of a channelised signalised intersection off the Townsville Port Road and the construction of

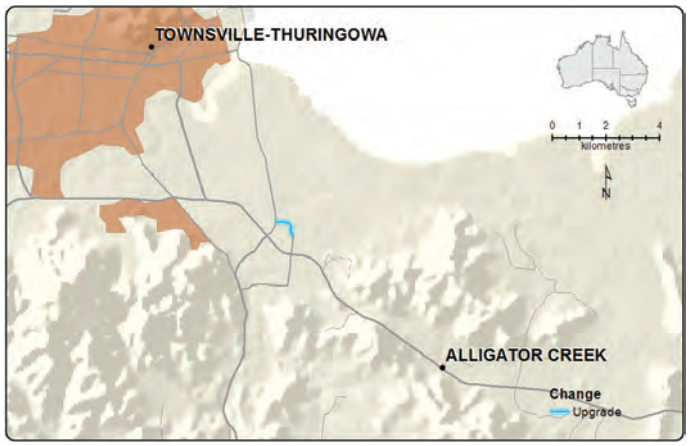

Figure 5.31: Segments of road upgraded to Type 2

SUMMARY OF RESULTS

Table 5.31 summarises the cost savings per annum, based on full vehicles (single trailers). These savings include the costs associated with the return journey of empty trailers.

TABLE 5.31: SUMMARY OF ANNUAL SAVINGS FROM TYPE 2 ACCESS TO STUART ABATTOIR

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	SAVINGS PER HEAD
Travel	$50,252		
Vehicle break down	$141,810		
Broader network	$78,319		
Total	**$270,379**	**7048**	**$1.92**

5.32 Upgrading to allow Type 2 access direct to Townsville port

DESCRIPTION OF THE MODELLED SCENARIO

Currently, road trains carrying cattle for live export need to decouple to semi-trailers before reaching Townsville port. For this scenario, the need for decoupling was removed with the upgrade of the roads to allow Type 2 vehicles (Figure 5.32). Note the scenario was based on live export numbers of about 203,824 cattle in 2013/2014.

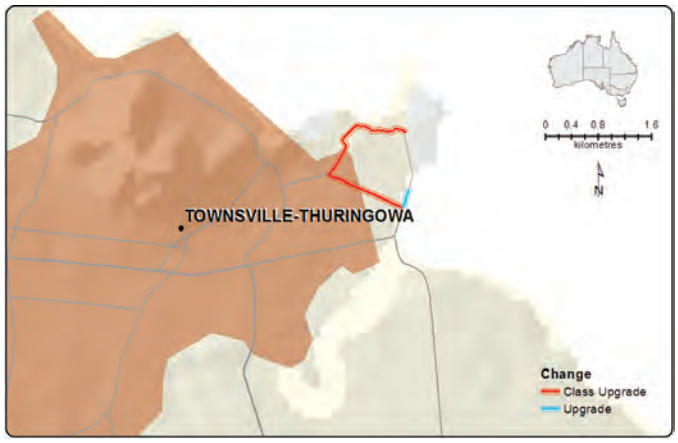

Figure 5.32: Segments of road upgraded to Type 2

SUMMARY OF RESULTS

Table 5.32 summarises the cost savings per annum, based on full vehicles (single trailers). These savings include the costs associated with the return journey of empty trailers.

TABLE 5.32: SUMMARY OF SAVINGS OF TYPE 2 ACCESS TO THE UNLOADING FACILITY AT TOWNSVILLE PORT

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	SAVINGS PER HEAD
Travel	$52,305		
Vehicle break down	$231,601		
Broader network	$0		
Total	**$283,906**	**6766**	**$1.41**

5.33 Sealing road between Bruce Highway and Stanage Bay

DESCRIPTION OF THE MODELLED SCENARIO

This scenario involves sealing unsealed sections between the Bruce Highway and Stanage Bay, to a B-Double standard (Figure 5.33).

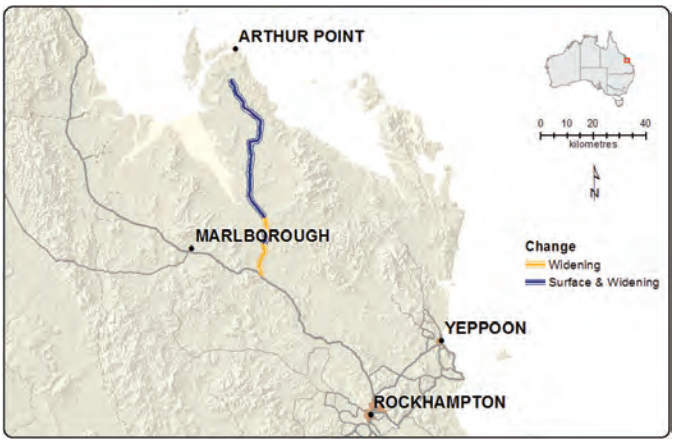

Figure 5.33: Segments of road from Bruce Highway to Stanage Bay being widened or sealed

SUMMARY OF RESULTS

Table 5.33 summarises the cost savings per annum, based on full vehicles (single trailers). These savings include the costs associated with the return journey of empty trailers.

TABLE 5.33: SUMMARY OF ANNUAL SAVINGS FROM BRUCE HIGHWAY TO STANAGE BAY UPGRADE

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	SAVINGS PER HEAD
Travel	$6,843		
Vehicle break down	$0		
Broader network	$531		
Total	**$7,374**	**74**	**$1.46**

5.34 Sealing unsealed section of the Dawson Developmental Road between Springsure and Tambo

DESCRIPTION OF THE MODELLED SCENARIO

Part of the Dawson Developmental Road between Springsure and Tambo (Queensland) is unsealed. For this scenario, the unsealed segments of road (Figure 5.34) were sealed.

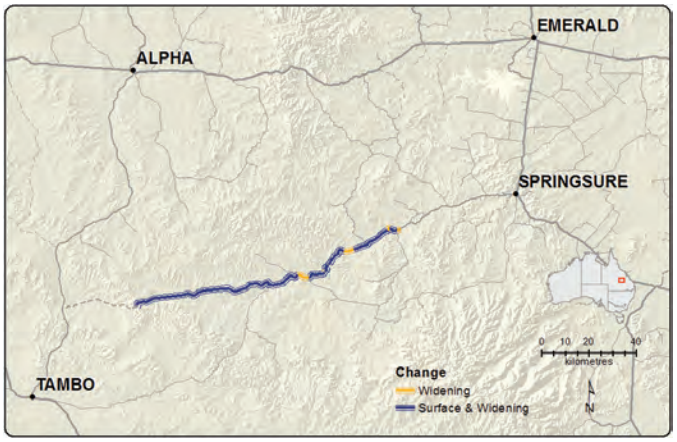

Figure 5.34: Segments of road along the Dawson Developmental road between Springsure and Tambo sealed

SUMMARY OF RESULTS

Table 5.34 summarises the cost savings per annum. Savings for the modified part of the road network are $37,717 for driving and a further $1,191 for break down of vehicles. Across the broader network, savings of $8,738 are due to more efficient use of roads and/or truck configurations due to this upgrade. These savings include the costs associated with the return journey of empty trailers.

TABLE 5.34: SUMMARY OF SAVINGS IF UNSEALED SECTIONS OF THE DAWSON DEVELOPMENTAL ROAD BETWEEN SPRINGSURE AND TAMBO ARE SEALED

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TRAILERS AFTER UPGRADE	SAVINGS PER HEAD
Travel	$37,717			
Vehicle break down	$1,191			
Broader network	$8,738			
Total	**$47,645**	**838**	**1387**	**$1.10**

5.35 Sealing a 100km section of the Fitzroy Developmental Road 85B between Duaringa and Bauhinia Downs

DESCRIPTION OF THE MODELLED SCENARIO

The Fitzroy Developmental Road 85B between Duaringa and Bauhinia Downs (Queensland) is unsealed. For this scenario, the unsealed segments of road (Figure 5.35) were sealed.

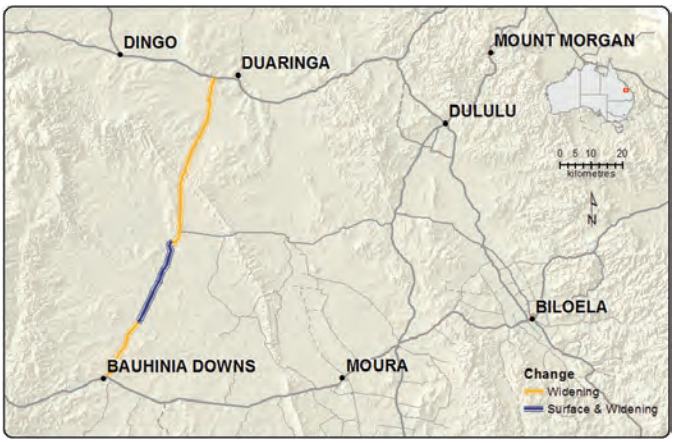

Figure 5.35: Segments of road between Duaringa and Bauhinia Downs that were sealed

SUMMARY OF RESULTS

Table 5.35 summarises the cost savings per annum. Savings for the modified part of the road network are $84,884 for driving and a further $3,560 for break down of vehicles. Across the broader network, savings of $13,771 are due to more efficient use of roads and/or truck configurations due to this upgrade. These savings include the costs associated with the return journey of empty trailers.

TABLE 5.35: SUMMARY OF SAVINGS IF 100KM SECTION OF FITZROY DEVELOPMENTAL ROAD 85B BETWEEN DUARINGA AND BAUHINIA DOWNS IS SEALED

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TRAILERS AFTER UPGRADE	SAVINGS PER HEAD
Travel	$84,884			
Vehicle break down	$3,560			
Broader network	$13,771			
Total	**$102,215**	**817**	**2042**	**$1.31**

5.36 Sealing a 27km section of the Blackwater to Rolleston Road

DESCRIPTION OF THE MODELLED SCENARIO

Part of the Blackwater to Rolleston Road (Queensland) is currently unsealed. For this scenario, the unsealed segments of road (Figure 5.36) were sealed.

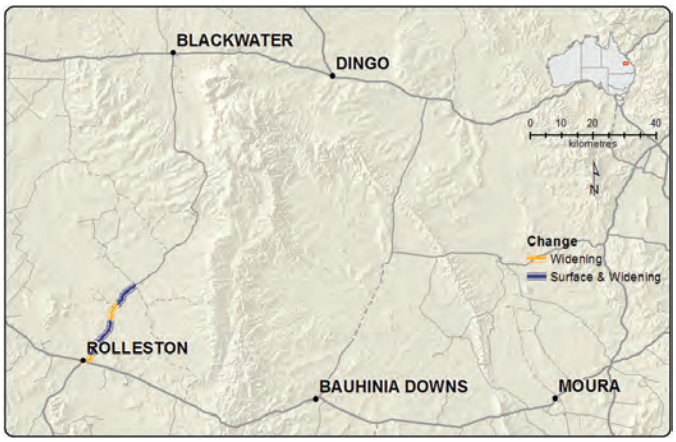

Figure 5.36: Segments of road between Rolleston and Blackwater to be sealed

SUMMARY OF RESULTS

Table 5.36 summarises the cost savings per annum. Savings for the modified part of the road network are $6,016 for driving and a further savings of $177 are due to more efficient use of roads and/or truck configurations due to this upgrade. These savings include the costs associated with the return journey of empty trailers.

TABLE 5.36: SUMMARY OF SAVINGS FOR SEALING/WIDENING OF 27KM SECTION OF BLACKWATER ROLLESTON ROAD

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TRAILERS AFTER UPGRADE	SAVINGS PER HEAD
Travel	$6,016			
Vehicle break down	$0			
Broader network	$177			
Total	**$6,193**	**905**	**1013**	**$0.19**

5.37 Rehabilitating and widening the Dawson Highway 46C – Rolleston to Moura Road

DESCRIPTION OF THE MODELLED SCENARIO

Part of the Dawson Highway between Rolleston and Moura (Queensland) is narrow and though sealed, is in poor condition. For this scenario, this section of the Dawson Highway (Figure 5.37) was widened.

Figure 5.37: Segment of road between Rolleston and Moura widened

SUMMARY OF RESULTS

Table 5.37 summarises the cost savings per annum. Savings for the modified part of the road network are $9,176 for driving and a further savings of $118 are due to more efficient use of roads and/or truck configurations due to this upgrade. These savings include the costs associated with the return journey of empty trailers.

TABLE 5.37: SUMMARY OF SAVINGS FOR REHABILITATION PAVING AND WIDENING OF DAWSON HIGHWAY 46C - ROLLESTON TO MOURA

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TRAILERS AFTER UPGRADE	SAVINGS PER HEAD
Travel	$9,176			
Vehicle break down	$0			
Broader network	$118			
Total	**$9,294**	**4108**	**4208**	**$0.08**

5.38 Sealing unsealed sections of the Fitzroy Developmental Road 85a – Taroom to Bauhinia Road

DESCRIPTION OF THE MODELLED SCENARIO

Part of the Fitzroy Developmental Road between Taroom and Bauhinia Downs (Queensland) is unsealed. For this scenario, this section of road (Figure 5.38) was sealed.

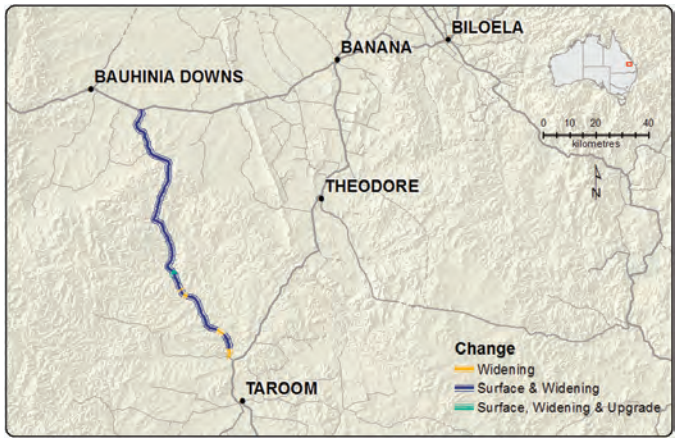

Figure 5.38: Segment of road between Taroom and Bauhinia Downs sealed

SUMMARY OF RESULTS

Table 5.38 summarises the cost savings per annum. Savings for the modified part of the road network are $442,684 for driving and a further $41,758 for break down of vehicles. Across the broader network, savings of $64,572 are due to more efficient use of roads and/or truck configurations due to this upgrade. These savings include the costs associated with the return journey of empty trailers.

TABLE 5.38: SUMMARY OF SAVINGS FOR SEALING OF UNSEALED SECTIONS OF FITZROY DEVELOPMENTAL ROAD 85A - TAROOM TO BAUHINIA ROAD

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TRAILERS AFTER UPGRADE	SAVINGS PER HEAD
Travel	$442,684			
Vehicle break down	$41,758			
Broader network	$64,572			
Total	**$549,015**	**239**	**4026**	**$4.32**

5.39 Sealing 45km of unsealed sections of the Comet River Road

DESCRIPTION OF THE MODELLED SCENARIO

Two sections (total 45km) of the Comet River Road - between Comet and Mira (Queensland) are unsealed. For this scenario, these sections of road (Figure 5.39) were sealed.

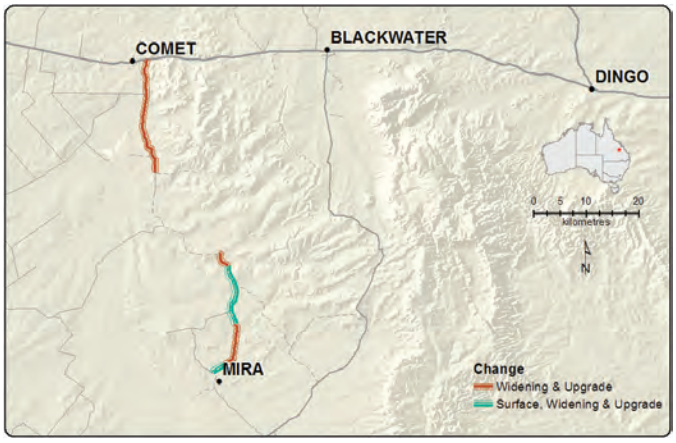

Figure 5.39: Segments of road between Comet and Mira sealed

SUMMARY OF RESULTS

Table 5.39 summarises the cost savings per annum. Savings for the modified part of the road network are $9,101 for driving and a further $338 for break down of vehicles. Across the broader network, savings of $1,298 are due to more efficient use of roads and/or truck configurations due to this upgrade. These savings include the costs associated with the return journey of empty trailers.

TABLE 5.39: SUMMARY OF SAVINGS FOR SEALING UNSEALED SECTIONS OF COMET RIVER ROAD (45KM)

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TRAILERS AFTER UPGRADE	SAVINGS PER HEAD
Travel	$9,101			
Vehicle break down	$338			
Broader network	$1,298			
Total	**$10,737**	**353**	**374**	**$0.37**

5.40 Sealing Ootann Road

DESCRIPTION OF THE MODELLED SCENARIO

Ootann Road, heading south from Almaden to the Kennedy Highway (Queensland) is currently unsealed, with 91km of gravel. For this scenario, this road (Figure 5.40) was sealed, and Type 1 segments upgraded to Type 2.

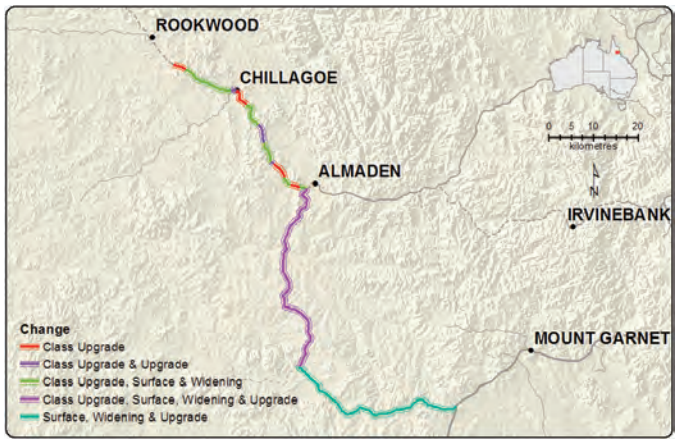

Figure 5.40: Segment of Ootann road to be upgraded, with the yellow increase from Type 1 to Type 2 access

Figure 5.40a: Impacts of upgrade on road network. Trailer numbers (per annum) in the map are based on trips containing cattle and not return journey of empty trailers

SUMMARY OF RESULTS

Table 5.40 summarises the cost savings per annum. Savings for the modified part of the road network are $60,130 for driving and a further $4570 for break down of vehicles. Across the broader network, savings of $23,643 are due to more efficient use of roads and/or truck configurations due to this upgrade. These savings include the costs associated with the return journey of empty trailers.

Figure 5.40a shows the impact of the Collinsville to Belyando upgrade on vehicle numbers (semi-trailer equivalents carrying cattle) across the network in that region. The blue numbers represent the number of trailers (with cattle) on the road segment before the upgrade and the red numbers after the upgrade. If the road is highlighted in blue, there is a net reduction in number of vehicles after the upgrade. If highlighted in red, there is a net increase in number of vehicles after the upgrade.

TABLE 5.40: SUMMARY OF SAVINGS FOR SEALING OF OOTANN ROAD

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TRAILERS AFTER UPGRADE	SAVINGS PER HEAD
Travel	$60,130			
Vehicle break down	$4,570			
Broader network	$23,643			
Total	**$88,343**	**51**	**367**	**$7.83**

5.41 Sealing unsealed sections of road between Richmond and Winton

DESCRIPTION OF THE MODELLED SCENARIO

Between Richmond and Winton there are 75km of unsealed sections of road. Under this scenario these sections were sealed (Figure 5.41).

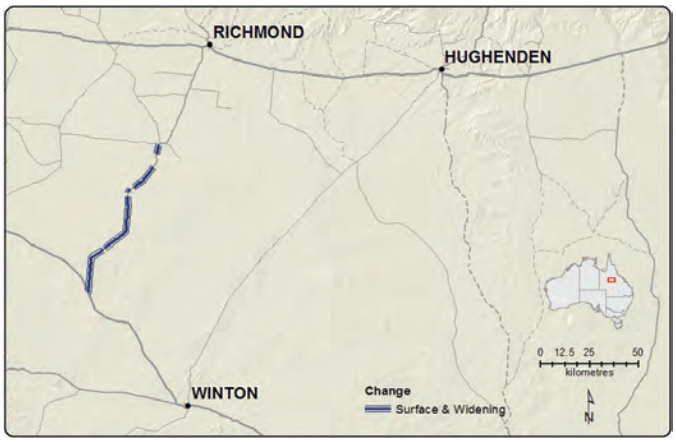

Figure 5.41: Location of sections of road between Winton and Richmond to be sealed under this scenario

SUMMARY OF RESULTS

Table 5.41 summarises the cost savings per annum. Savings for the modified part of the road network are $168,923 for driving and a further $27,880 for break down of vehicles. Across the broader network, savings of $33,412 are due to more efficient use of roads and/or truck configurations due to this upgrade. These savings include the costs associated with the return journey of empty trailers.

TABLE 5.41: SUMMARY OF SAVINGS FOR SEALING OF ROAD SEGMENTS BETWEEN WINTON AND RICHMOND

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TRAILERS AFTER UPGRADE	SAVINGS PER HEAD
Travel	$168,923			
Vehicle break down	$27,880			
Broader network	$33,412			
Total	**$230,215**	**1878**	**3112**	**$1.87**

6 Western Australia Submissions

6.1 Broome Highway - truck staging area into port

DESCRIPTION OF THE MODELLED SCENARIO

This scenario is based on 94,560 cattle (2013/2014) exported through the port. The export numbers vary considerably depending on the calendar or financial year, and the savings shown in this report can be adjusted accordingly. Type 2 road trains have access to the port, and the benefit of this upgrade is reduced queue times at the port. Information was not available on current truck queue times and turn around times, so this scenario is based on per hour waiting time saved per vehicle.

SUMMARY OF RESULTS

Table 6.1 shows the savings per annum, based on one hour reduction in waiting time at the port. The savings need to be adjusted for the actual reduction in waiting time that would be achieved by the staging area.

TABLE 6.1: SUMMARY OF SAVINGS FROM TRUCK STAGING AREA AT BROOME PORT

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	SAVINGS PER HEAD PER HOUR OF REDUCED WAITINGTIME
Travel			
Vehicle break down			
Broader network			
Total	**$92,925**	**3150**	**$0.98**

6.2 Sealing of Duncan Road between Hall Creek and the NT border

Table 6.2 summarises the cost savings per annum, based on full vehicles (single trailers). These savings include the costs associated with the return journey of empty trailers.

TABLE 6.2: SUMMARY OF SAVINGS FOR SEALING DUNCAN ROAD BETWEEN HALL CREEK AND NT BORDER

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TRAILERS AFTER UPGRADE	SAVINGS PER HEAD
Travel	$4,228			
Vehicle break down				
Broader network	$7,670			
Total	**$11,898**	**58**	**66**	**$1.10**

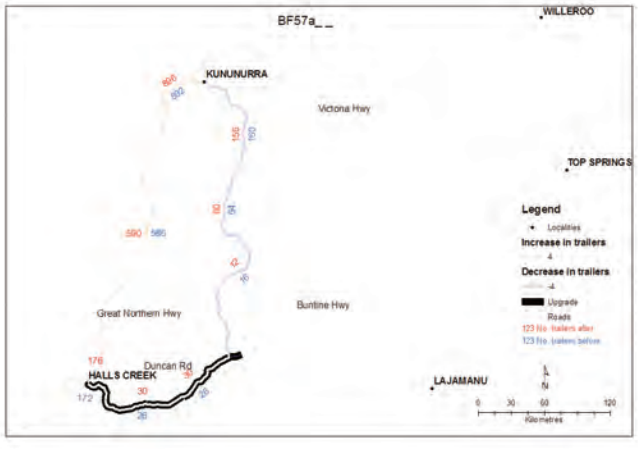

Figure 6.2: Impact of trailer numbers (per annum) before and after the upgrade. Trailer numbers in the map are based on trips containing cattle and not return journey of empty trailers

Figure 6.2 shows the impact of the Duncan Road plus on vehicle numbers (semi-trailer equivalents carrying cattle) across the network in that region. The blue numbers represent the number of trailers (with cattle) on the road segment before the upgrade and the red numbers after the upgrade. If the road is highlighted in blue, there is a net reduction in number of vehicles after the upgrade. If highlighted in red, there is a net increase in number of vehicles after the upgrade.

6.3 Wyndham Spur upgrade and widening the Great Northern Highway

DESCRIPTION OF THE MODELLED SCENARIO

For this scenario, 18.6 km section of narrow road were widened to 9 metres sealed, and the spur north to the port was upgraded (Figure 6.3).

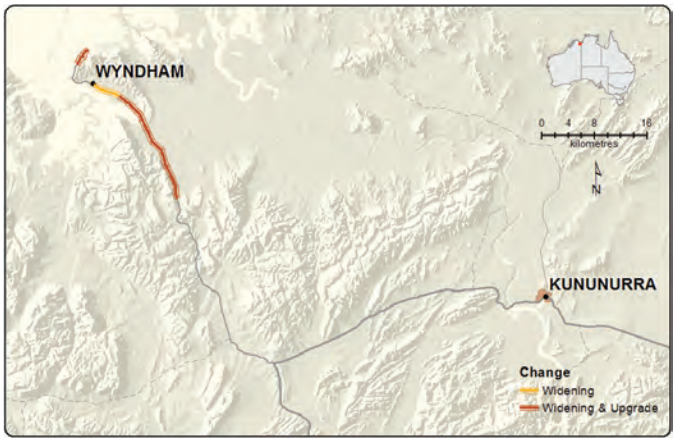

Figure 6.3: Segments of Wyndham Spur Highway upgraded

SUMMARY OF RESULTS

Table 6.3 summarises the cost savings per annum, based on full vehicles. These savings include the costs associated with the return journey of empty trailers.

TABLE 6.3: SUMMARY OF SAVINGS FOR UPGRADING THE WYNDHAM HIGHWAY NORTH AND SOUTH OF WYNDHAM

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TOTAL CATTLE AFTER UPGRADE	SAVINGS PER HEAD
Travel	$3,700			
Vehicle break down	$0			
Broader network	$118			
Total	**$3,818**	**1858**	**1858**	**$0.05**

6.4 Widening the Ord and Turkey Creek sections of the Great Northern Highway

DESCRIPTION OF THE MODELLED SCENARIO

The Ord and Turkey Creek sections of the Great Northern Highway (WA) are currently a narrow two way road. For this scenario, these sections of road (Figure 6.4) were widened and sealed at three priority locations, leading to a slight improvement in travel time in some sections.

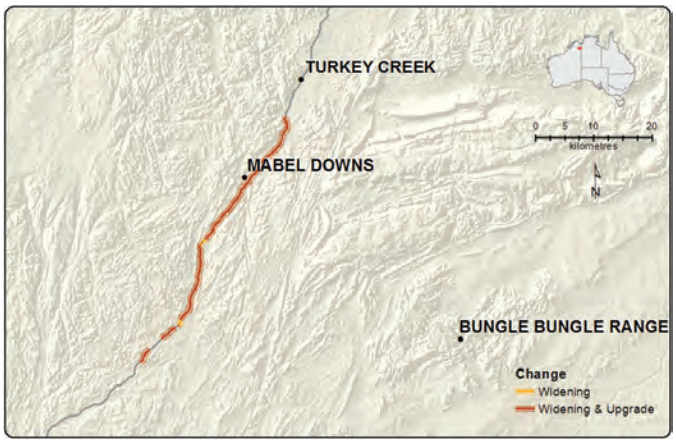

Figure 6.4: Segments of Great Northern Highway widened

SUMMARY OF RESULTS

Table 6.4 summarises the cost savings per annum, based on full vehicles (single trailers). These savings include the costs associated with the return journey of empty trailers.

TABLE 6.4: SUMMARY OF SAVINGS FOR WIDENING ORD AND TURKEY CREEK SECTIONS OF THE GREAT NORTHERN HIGHWAY

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	SAVINGS PER HEAD
Travel	$689		
Vehicle break down	$0		
Broader network	$118		
Total	**$807**	**1172**	**$0.03**

6.5 Great Northern Highway bridge upgrades

DESCRIPTION OF THE MODELLED SCENARIO

Location of proposed bridges is at Turkey Creek (WA) on the Great Northern Highway (Figure 6.5), which will replace low level flood ways. By implementing the upgrade, it will lead to small reduction in travel time and reduce the number of average number of days per year the road is blocked due to flooding. In 2011, the Great Northern Highway in that region was closed for 13 days due to flooding (Western Australian Department of Main Roads data). The scenario was divided into two component. Component A considers the transport costs savings from installing the bridges, through travel time efficiencies. Component B considers the savings from reduced road closures from flooding.

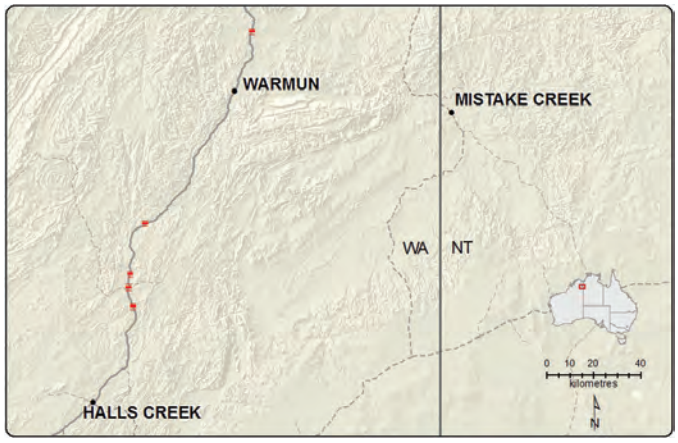

Figure 6.5: Segment of Great Northern highway upgraded according to Scenario 60

SUMMARY OF RESULTS

Table 6.5 summarises the cost savings per annum for component A of the scenario. The savings include lower transport costs from slight reductions in travel time, and include the cost savings from return journey of empty trailers.

TABLE 6.5: SUMMARY OF SAVINGS (FROM TRAVEL TIME) FOR REPLACING FLOOD WAYS WITH BRIDGES AT TURKEY CREEK ON THE GREAT NORTHERN HIGHWAY

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	SAVINGS PER HEAD
Travel	$747		
Vehicle break down	$0		
Broader network	$0		
Total	**$747**	**1172**	**$0.02**

Component B of the scenario considers the transport cost savings due to the reduced frequency that the road is closed due to flooding. In the event the road is flooded, the model rerouted vehicles along alternative roads between origins and destinations. Often these detours can be significant. If the Great Northern Highway at Turkey Creek was blocked all year round, the total additional cost for livestock transport (resulting from the detour) would be $260,715 per year or $222 per trailer or $666 per Type 2 road train. If the highway was blocked 3.5% of days per year (based on 13 days per year blocked, 2011 data), the expected detour cost of livestock transport (including return journey empty vehicles) would be $9,125 (Table 6.5a). The actual costs will depend on the time of year the road closures take place, due to the variation of cattle transport by month of year. The actual costs will also depend on closures of other roads from the same flood event. These savings include the costs associated with the return journey of empty trailers.

TABLE 6.5A: SUMMARY OF SAVINGS, FROM REDUCED ROAD FLOODING) FOR REPLACING FLOOD WAYS WITH BRIDGES AT TURKEY CREEK ON THE GREAT NORTHERN HIGHWAY. THIS IS BASED ON ROAD BEING CLOSED DUE TO FLOODING 3.5% OF A YEAR BEFORE THE UPGRADE.

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	SAVINGS PER HEAD
Travel			
Vehicle break down			
Broader network			
Total	**$9,125**	**1172**	**$0.26**

7 Other Submissions

Other submissions include one or more of the following features:

- multi jurisdictional;
- involved transport to a proposed facility rather than an existing facility. These submissions were modelled based on forecasted or likely cattle numbers; or
- not able to be evaluated in the current version of TraNSIT. These submissions only produced benefits (e.g. safety) that the current version of TraNSIT does not consider.

7.1 Sealing unsealed sections of the Outback Way

DESCRIPTION OF THE MODELLED SCENARIO

Sealing all unsealed sections of the Outback Way between Winton and Laverton (Figure 7.1).

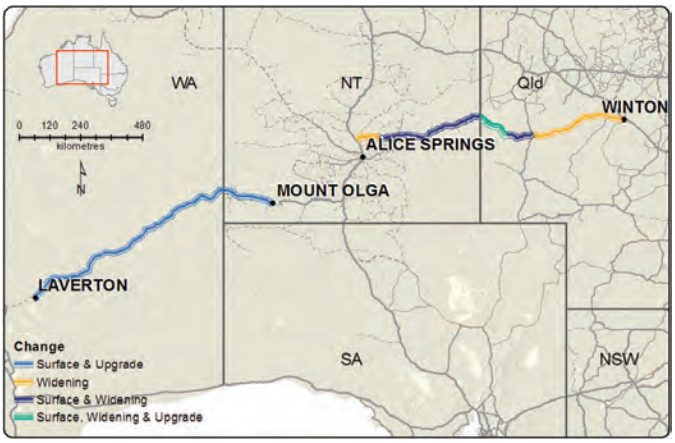

Figure 7.1: Segments of the Outback Way upgraded

SUMMARY OF RESULTS

Table 7.1 shows the summary of savings by sealing the full length of the Outback Way upgrade. Figure 7.1a shows the impact of the Outback Way on vehicle numbers (semi-trailer equivalents with cattle) across the network in that region. The blue numbers represent the number of trailers (with cattle) on the road segment before the upgrade and the red numbers after the upgrade. If the road is highlighted in blue, there is a net reduction in number of vehicles after the upgrade. If highlighted in red, there is a net increase in number of vehicles after the upgrade. A notable trend is that the majority of vehicle movements are between Winton and Boulia, with the segment of the Outback Way in Western Australia having fewer vehicle movements. The figure shows an increase in vehicle movements if the road was sealed.

TABLE 7.1: SUMMARY OF SAVINGS IF SEALING THE OUTBACK WAY AS PER THE SCENARIO

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	TRAILERS AFTER UPGRADE	SAVINGS PER HEAD
Travel	$842,299			
Vehicle break down	-$23,401			
Broader network	$360,645			
Total	**$1,179,543**	**458**	**1158**	**$3.71**

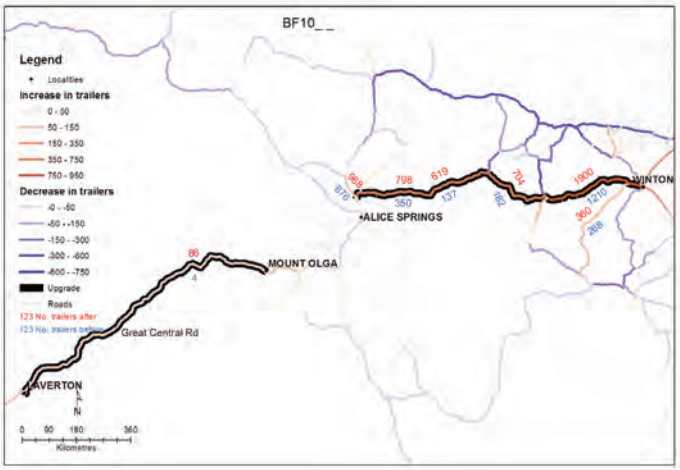

Figure 7.1a: Impact in freight flows before and after the upgrade. Trailer numbers (per annum) in the map are based on trips containing cattle and not return journey of empty trailers

7.2 Type 2 access to a proposed new Wellard Export Depot

DESCRIPTION OF THE MODELLED SCENARIO

This scenario considers Type 2 vehicle access to a proposed Wellard Live Export Facility that would be built off the Flinders Highway at Woodstock (Figure 7.2). Currently, access to the proposed facility is limited to semi-trailers, and vehicle travelling to the facility from the west would need to decouple at a breakdown pad before entering the site. Trailers would reconfigure to Type 2 vehicles before transport to Townsville Port.

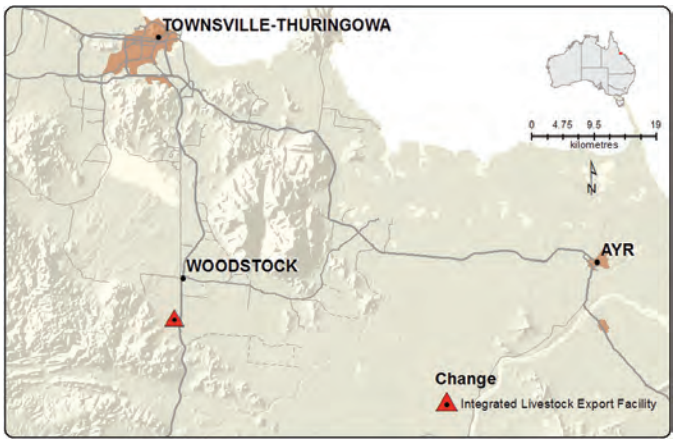

Figure 7.2 Location of proposed Wellard Live Export Facility

SUMMARY OF RESULTS

Table 7.2 summarises the cost savings per annum. It is based on the proposed new Wellard Live Export Facility assuming all Wellard live export cattle through Townsville will use this facility, which was 203,824 in 2013/2014. The savings accommodate efficiencies gained from not having to break down to semi-trailers to gain access to the proposed facility. The analysis does not accommodate any benefits or dis-benefits from no longer using existing Export Depot facilities near Townsville.

TABLE 7.2: SUMMARY OF SAVINGS FOR THE PROPOSED WELLARD LIVE EXPORT FACILITY

	SAVINGS PER ANNUM	TRAILERS PER ANNUM	SAVINGS PER HEAD
Travel	$52,305		
Vehicle break down	$231,601		
Broader network	$0		
Total	**$283,906**	**6766**	**$1.41**

7.3 Scenarios not evaluated

The following submissions were not evaluated:

- *New breakdown pads proposed by the Queensland Department of Transport and Main Roads*. The current version of TraNSIT would show little transport cost savings unless the loading pads enables more travel distance in higher productivity vehicles than existing pads. TraNSIT also uses approximate locations of existing breakdown pads.
- *Australian Agricultural Company (AACo) submission on upgrade of bridges on Buntine highway*. This will be modelled in the future.
- *AACo submission on higher combination vehicles to AACo stations*. This will be modelled in the future.
- *Northern Territory Livestock Export Association redevelopment proposal for Berrimah Export Yards*. This proposal will lead to several benefits to the export facility, but no transport benefits that TraNSIT could analyse.
- *Access plan for the Wellard Integrated Livestock Export Facility at Livingstone*. The proposal is for improvements to the shared Type 2 vehicle access from the Stuart highway. Primary benefits are increased safety, and TraNSIT would not show any transport cost savings.

References

Higgins AJ, McFallan S, Laredo LA, Prestwidge D (2015) Cost of transport infrastructure and regulatory constraints in Australian cattle supply chains. CSIRO report submitted to Meat and Livestock Australia. Released in late 2015.

Higgins A, Watson I, Chilcott C, Zhou M, Garcia-Flores R, Eady S, McFallan S, Prestwidge D, Laredo L. (2013). Optimising Capital Investment and Operations for the Livestock Industry in Northern Australia. The Rangeland Journal, 35, 181-191.

Higgins A, McFallan S, Laredo L, Prestwidge D, Stone P. (2015). TraNSIT- A model for simulating infrastructure and policy interventions in agriculture logistics: Application to the northern Australia beef industry Computers and Electronics in Agriculture. Computers and Electronics and Agriculture, 114, 32-42.

Appendix A: Outline of TraNSIT

TraNSIT is a computer-based tool, designed to assess costs and benefits associated with infrastructure investments and policy changes impacting commodity transport. The outputs provide options for most efficient investment.

TraNSIT was constructed in the ArcGIS platform due to its vehicle routing capability whilst accommodating multiple characteristics associated with the road/rail network and individual road/rail segments. Road rankings (primary, secondary and minor (including unsealed roads)) are shown in Figure A1 and affect average speed, transport cost per km and the route taken. Road access restrictions for Single, B-Double, Type 1 and Type 2 vehicles are also specified (Figure A1). Different restrictions will exist for different commodities due to their supply chain paths. For example, with cattle transport in Australia, the main restrictions are in moving cattle to east coast abattoirs and ports, as access roads to these facilities are limited to B-double access. Not only is there a higher cost per tonne (Table A1) for transport using smaller vehicle combinations, but there is an additional cost for breaking down larger vehicles (e.g. Type 2) into smaller configurations (e.g. B-Double). Another restriction is the requirement of tick clearing when transporting cattle from a tick-infested location to a tick-free location. Drivers will often avoid travelling into the tick-free zone (where possible) even if/when it involves a significant detour and a higher transport cost.

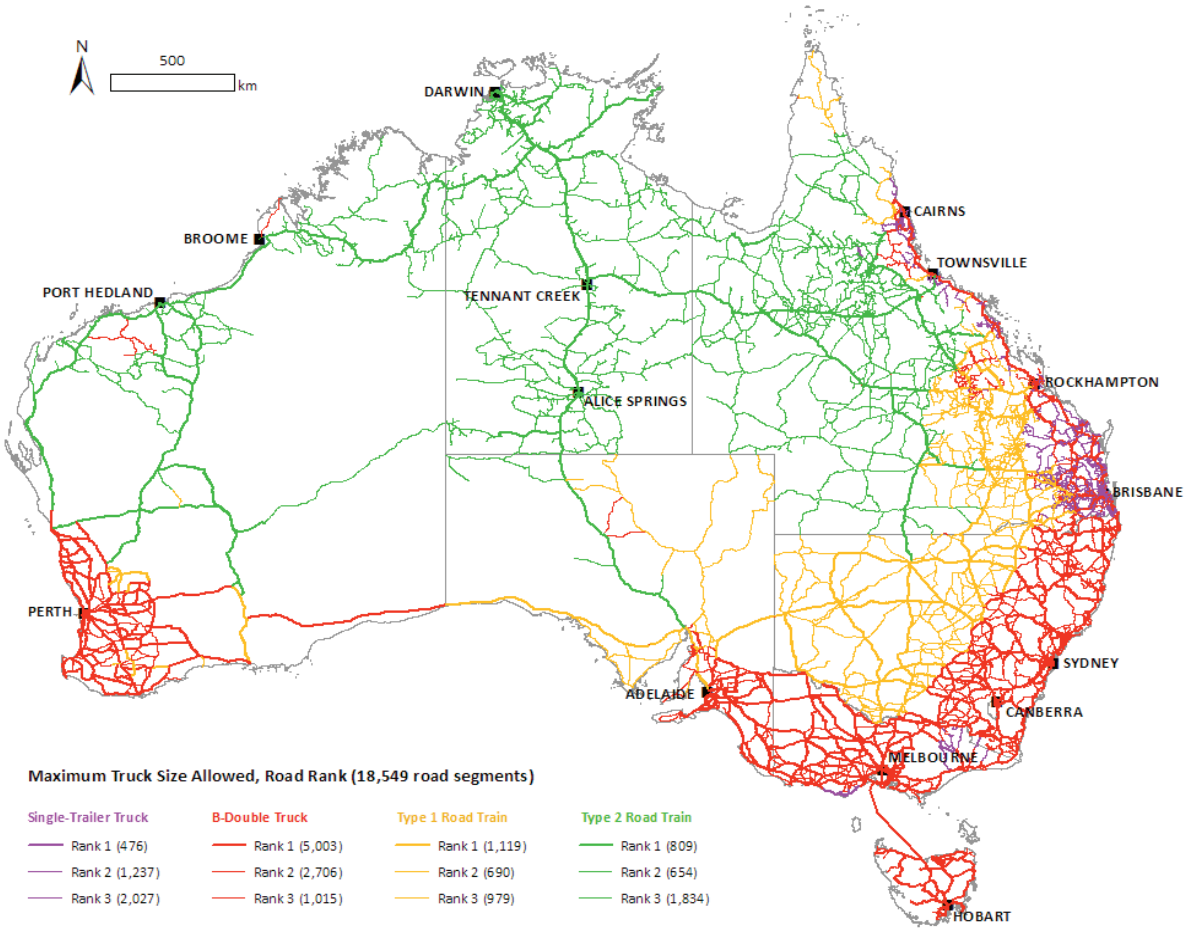

Figure A1: Accessibility and road ranking map of heavy vehicles in Australia, with accessibility based on National Heavy Vehicle Regulations

TABLE A1: ROAD TRANSPORT COSTS PER CATTLE VEHICLE

VEHICLE CLASSIFICATION	COST (A$/KM) FOR A GIVEN TRAVEL SPEED				IDLE COST ($/HR)
	100 km/h	80 km/h	60 km/h	40 km/h	
Single Trailer	1.91	2.16	2.58	3.43	119
B-Double	2.35	2.64	3.13	4.10	141
Type 1	2.71	3.02	3.54	4.57	169
Type 2	3.43	3.78	4.36	5.52	177

A process diagram of TraNSIT is provided in Figure A2. TraNSIT is based on simulating the number of vehicle trips per month moved between origin and destination enterprises. The goal of the TraNSIT module is to optimise (based on travel time) the transport route along the road/rail network for each of these trips from origin to destination, and then calculate the cumulative impacts at the enterprise or regional scale whilst evaluating against constraints on the number of vehicle trips on each route. To determine the optimal route, the analysis takes into account such parameters as costs, restrictions or hierarchical value. It is essential that all these parameters work together logically, to allow proper solving of optimal routes. Network segments must be linked to neighbouring segments and carry attributes that will enable travel through, unless a restriction is in place. Since a property is not always geographically attached to a road, a trip from an origin to destination (O-D) is modelled to have travelled to the closest road segment from the origin, and finishing at the closest point on a road segment to the destination point. This process is repeated for all routes, always searching for the minimum cost (including penalty costs) and selecting it as the optimal route. These costs are then aggregated over all O-D pairs to provide a total cost of transport for the scenario.

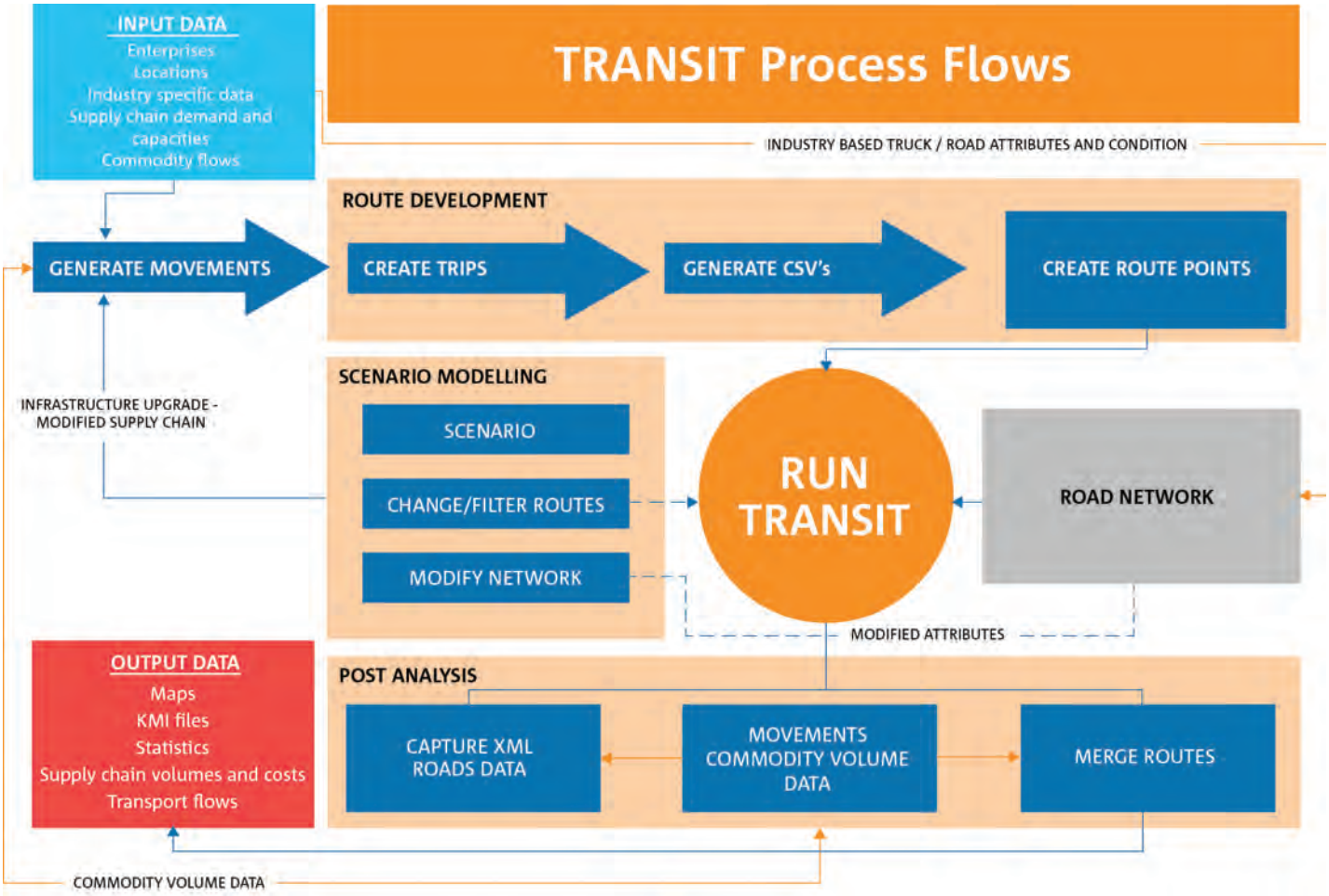

Figure A2: Technical diagram of TraNSIT, showing the stages of setting up and running each model component

CONTACT US

t 1300 363 400
+61 3 9545 2176
e csiroenquiries@csiro.au
w www.csiro.au

AT CSIRO, WE DO THE EXTRAORDINARY EVERY DAY

We innovate for tomorrow and help improve today – for our customers, all Australians and the world.

Our innovations contribute billions of dollars to the Australian economy every year. As the largest patent holder in the nation, our vast wealth of intellectual property has led to more than 150 spin-off companies.

With more than 5,000 experts and a burning desire to get things done, we are Australia's catalyst for innovation.

CSIRO. WE IMAGINE. WE COLLABORATE. WE INNOVATE.

CONTRIBUTORS TO THIS REPORT

CSIRO Land and Water

Andrew Higgins
t +61 7 3833 5738
e Andrew.Higgins@csiro.au
w www.csiro.au/TraNSIT

Stephen McFallan
t +61 7 3833 5722
e Stephen.McFallan@csiro.au

Adam McKeown
t +617 4059 5009
e Adam.Mckeown@csiro.au

Luis Laredo
t +617 3833 5719
e Luis.Laredo@csiro.au

Matt Beaty
t +612 6246 4381
e Matt.Beaty@csiro.au

CSIRO Agriculture

Caroline Bruce
t +617 4059 5024
e Caroline.Bruce@csiro.au

TraNSIT

This initiative has been part funded through the Australian Government White Paper on Developing Northern Australia

16-00208