TraNSIT - Unlocking options for efficient logistics infrastructure in Australia
Andrew Higgins and Stephen McFallan – CSIRO Land and Water
What is special about TraNSIT?

- Comprehensive mapping of All Australia’s agriculture and forestry freight
- Insights into freight task, bottlenecks and inefficiencies.

What can TraNSIT do for you?

- Inform infrastructure investment and regulatory changes
- Shows impacts on all agricultural and forestry enterprises and across the supply chain
- Considers soft (eg. policy, regulation)
- and hard infrastructure (bridge, roads, rail, hubs, processing plant...)
Transport Network Strategic Investment Tool - TraNSIT

Beginnings and rationale
• Initially developed for northern Australia beef in 2013
• Long distance transport and vulnerable supply chains
• Infrastructure investment - holistically evaluate best options

A modular transport network analysis tool
• Maps and optimises every vehicle movement
• Across the supply chain - farm – storage - processing – market
• Ground up road and rail transport costing
• Includes associated costs: food losses; driver fatigue; etc
**TraNSIT features**

**Network**
- Roads and features
- Rail lines and load points

**Vehicle and trains**
- Costs model
- Optimal vehicle selection

**Commodities**
- Enterprise locations
- Demands or supplies

**Calculation**
- Vehicle route optimisation

<table>
<thead>
<tr>
<th>Type</th>
<th>100 km/h</th>
<th>60 km/h</th>
<th>20 km/h</th>
<th>Good Unsealed</th>
<th>Poor Unsealed</th>
<th>Idle cost ($/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semitrailer</td>
<td>1.91</td>
<td>2.58</td>
<td>6.11</td>
<td>0.09</td>
<td>0.26</td>
<td>119</td>
</tr>
<tr>
<td>B-Double</td>
<td>2.35</td>
<td>3.13</td>
<td>7.36</td>
<td>0.13</td>
<td>0.39</td>
<td>141</td>
</tr>
<tr>
<td>Type 1</td>
<td>2.71</td>
<td>3.54</td>
<td>6.81</td>
<td>0.16</td>
<td>0.49</td>
<td>169</td>
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<tr>
<td>Type 2</td>
<td>3.43</td>
<td>4.36</td>
<td>8.22</td>
<td>0.24</td>
<td>0.72</td>
<td>177</td>
</tr>
</tbody>
</table>

Maximum heavy vehicle size allowed, Road rank

- Single-Trailer Truck
- B-Double Truck
- Type 1 Road Train
- Type 2 Road Train

CSIRO
Enterprises (agri-businesses, silos, gins, abattoirs, sawmills, supermarkets etc.)

> 230,000 enterprises
TraNSIT route optimisation

Origin

Route

Destination
Impacts and achievements

- Most extensive agricultural transport data set and modelling ever assembled
  - Over 80 government agencies, associations and industry groups involved
  - 235,000 enterprises from farming to processing and markets
    - Plus 180,000 for forestry and other commodities
  - Over 5 million vehicle trips and 10,000 rail trips routed

- Inform government investment in roads
  - $100 million Northern Australia Beef Roads programme
    - Picked the best projects to fund and increased transport cost savings by 72%

- Changed regulation in transported related biosecurity
  - Reduced transport costs of cattle by $1.5 million per year

- Improved access to processing and markets
  - Last mile, high productivity vehicles, inter-modal

- Identified and prioritised bottlenecks across Australia
Average vehicles per year

Beef, Grains, Dairy, Rice, Sugar, Cotton, Horticulture, Pigs, Poultry, Sheep, Goats, Stock feed, Buffalo
Average rail usage per year
Beef, Grains, Sugar, Cotton
Average vehicles per year - Beef

Cattle - Number of trailers

- 1 - 300
- 301 - 900
- 901 - 1,600
- 1,601 - 2,600
- 2,601 - 4,000
- 4,001 - 5,600
- 5,601 - 8,100
- 8,101 - 12,200
- 12,201 - 18,500
- 18,501 - 32,000
Average vehicles per year - Grains

Grains - Number of trailers
- 1 - 1,000
- 1,001 - 3,000
- 3,001 - 5,500
- 5,501 - 9,000
- 9,001 - 13,000
- 13,001 - 18,000
- 18,001 - 27,000
- 27,001 - 40,000
- 40,001 - 60,000
- 60,001 - 110,000
# Modelled annual transport costs

<table>
<thead>
<tr>
<th></th>
<th>Road ($m)</th>
<th>Rail ($m)</th>
<th>Road CO₂ (tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef#</td>
<td>$572.4</td>
<td>$31.6</td>
<td>244,082</td>
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<tr>
<td>Grain</td>
<td>$2,149.7</td>
<td>$487.3</td>
<td>862,184</td>
</tr>
<tr>
<td>Pigs</td>
<td>$29.0</td>
<td></td>
<td>11,156</td>
</tr>
<tr>
<td>Rice</td>
<td>$134.2</td>
<td></td>
<td>55,437</td>
</tr>
<tr>
<td>Dairy</td>
<td>$881.7</td>
<td></td>
<td>337,294</td>
</tr>
<tr>
<td>Sugar</td>
<td>$52.2</td>
<td>$9.9</td>
<td>16,174</td>
</tr>
<tr>
<td>Sheep/Goats</td>
<td>$221.8</td>
<td></td>
<td>85,883</td>
</tr>
<tr>
<td>Cotton</td>
<td>$76.9</td>
<td>$13.2</td>
<td>36,385</td>
</tr>
<tr>
<td>Horticulture</td>
<td>$617.8</td>
<td></td>
<td>256,295</td>
</tr>
<tr>
<td>Post Processing*</td>
<td>$249.7</td>
<td></td>
<td>98,080</td>
</tr>
<tr>
<td>Mixed (DC to Market)^</td>
<td>$284.5</td>
<td></td>
<td>109,157</td>
</tr>
<tr>
<td>Poultry</td>
<td>$28.2</td>
<td></td>
<td>8,766</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$5,298.3</td>
<td>$542.1</td>
<td>2,120,893</td>
</tr>
</tbody>
</table>

*including a small number (20,000 head) of Buffalo
*includes boxed beef, chicken, lamb, pork to domestic markets and port
^mixture of horticulture and post processed commodities between DC’s and supermarkets

These represent the total transport costs across the supply chain from paddock to domestic market (except grain) or port.
Modelled transport costs – beef supply chain

- **Property**
  - $184.63m
  - $24.74/h

- **Saleyard**
  - $134.5m
  - $26.35/h

- **Feedlot**
  - $35.48m
  - $13.28/h

- **Rail point**
  - $5.013m
  - $24.86/h

- **Abattoir**
  - $135.01m
  - $45.30/h
  - $132.77/h
  - $75.02m
  - $124.58/t

- **Distribution Centre**
  - $31.65m
  - $132.77/h

- **Export depot**
  - $17.09m
  - $22.81/h

- **Port**
  - $4.89m
  - $6.50/h

- **Supermarket**
  - $69.7m
  - $32.72/h

- **Port**
  - $17.09m
  - $22.81/h
  - $4.89m
  - $6.50/h

- **Saleyard Feedlot Rail point**
  - $135.01m
  - $45.30/h
  - $132.77/h

- **Distribution Centre Supermarket**
  - $75.02m
  - $124.58/t

- **Property Port**
  - $17.09m
  - $22.81/h
  - $4.89m
  - $6.50/h
Applications over last 18 months

- Northern Australia White Paper Initiative
  - $100 million Beef Roads Programme
- Various road upgrade and last mile bottlenecks
  - Road sealing, volumetric loading, road flood proofing, HPV
- Impact of processor disruption – Kingaroy pork abattoir
- Providing baseline analysis to state agencies
- Applications with Temora and Toowoomba councils
- Toowoomba Second Range Crossing
- Impact of NSW floods in late 2016
- Shifting agriculture from road to rail
- New feedlots
- ARTC - freight hubs
Pinch points for Grain Movements - December
Pinch points for Grain Movements – to Hubs
Case Study – NSW floods - Forbes Shire

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Trailers Sept/Oct</th>
<th>Additional transport costs</th>
<th>Additional cost / tonne or head</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef</td>
<td>622</td>
<td>$0.2 m</td>
<td>$6.90</td>
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<tr>
<td>Dairy</td>
<td>20</td>
<td>$0.03 m</td>
<td>$5.68</td>
</tr>
<tr>
<td>Grains</td>
<td>331</td>
<td>$0.1 m</td>
<td>$12.81</td>
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<tr>
<td>Horticulture</td>
<td>2,420</td>
<td>$0.4 m</td>
<td>$6.33</td>
</tr>
<tr>
<td>Processed</td>
<td>2,852</td>
<td>$0.8 m</td>
<td>$9.20</td>
</tr>
<tr>
<td>Sheep &amp; Goat</td>
<td>678</td>
<td>$0.4 m</td>
<td>$1.43</td>
</tr>
</tbody>
</table>
Toowoomba Second Range Crossing
## Toowoomba Second Range Crossing – Savings per annum

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Total Savings</th>
<th>Semi-Trailer Equivalents (full loads)</th>
<th>Savings per Trailer (one way)</th>
<th>Savings per tonne or head transported</th>
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</thead>
<tbody>
<tr>
<td>Beef</td>
<td>$1,694,400</td>
<td>27,385</td>
<td>$30.94</td>
<td>$1.55</td>
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<tr>
<td>Chicken</td>
<td>$1,137</td>
<td>5,914</td>
<td>$0.10</td>
<td>$0.00</td>
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<tr>
<td>Cotton</td>
<td>$432,253</td>
<td>10,507</td>
<td>$20.57</td>
<td>$4.78</td>
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<tr>
<td>Dairy</td>
<td>$16,306</td>
<td>540</td>
<td>$15.10</td>
<td>$1.32</td>
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<tr>
<td>Grains</td>
<td>$1,501,357</td>
<td>39,483</td>
<td>$19.02</td>
<td>$1.41</td>
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<tr>
<td>Horticulture</td>
<td>$522,185</td>
<td>13,575</td>
<td>$19.24</td>
<td>$1.54</td>
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<tr>
<td>Pigs</td>
<td>$25,756</td>
<td>1,212</td>
<td>$10.63</td>
<td>$0.11</td>
</tr>
<tr>
<td>Post-Processed</td>
<td>$1,206,992</td>
<td>31,759</td>
<td>$19.00</td>
<td>$1.90</td>
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<tr>
<td>Sheep/goat</td>
<td>$2,591</td>
<td>270</td>
<td>$4.80</td>
<td>$0.05</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>$5,402,976</strong></td>
<td><strong>130,645</strong></td>
<td><strong>$20.68</strong></td>
<td><strong>-</strong></td>
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</tbody>
</table>
Toowoomba Second Range Crossing
Change in freight volumes after construction
## Case study – move all Rail to Road

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Existing Rail costs ($m)</th>
<th>Cost if transported by Road ($m)</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef</td>
<td>$36.6#</td>
<td>$10.9</td>
<td>-$25.8</td>
</tr>
<tr>
<td>Grains</td>
<td>$487.3</td>
<td>$696.1</td>
<td>$208.8</td>
</tr>
<tr>
<td>Cotton</td>
<td>$15.7#</td>
<td>$12.5</td>
<td>-$3.2</td>
</tr>
<tr>
<td>Sugar</td>
<td>$9.9</td>
<td>$12.1</td>
<td>$2.2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$552</strong></td>
<td><strong>$732</strong></td>
<td><strong>$180</strong></td>
</tr>
</tbody>
</table>

# Includes $5.0m in road transport costs to rail siding

## Includes $2.5m in road transport costs to rail siding
Case study – move all Rail to Road
Changes in road freight volumes
Modelled supply chain
Plantation forestry

- **Plantations**
  - 2.2 m³
  - 240 m³

- **Posts and Poles**
  - 2.2 m³

- **Saw Mill**
  - 29 m³
  - 289 m³
  - 13 m³ (Chips)

- **Panel Mill**
  - 42 m³
  - 39 m³
  - Chips

- **Chip and pole export**
  - 4.8 m³

- **Fire wood**
  - 2.0 m³

- **Ply Mill**
  - 29 m³

- **Timber export**
  - 42 m³

- **Pulp Mill**
  - 42 m³
  - 81 m³

- **Paper Mill**
  - 81 m³
Forestry supply chain – HQ Plantations
Including forest trails
Current/Future developments of TransIT

- Technical: adding sea and air transport, more detailed transport cost models, visualisation interface
- Migrating to commercial road network - HERE
- New projects e.g.
  - Capacity constraints and inefficiencies in the livestock export chain – MLA
  - ARTC – Freight hubs
  - Toowoomba Regional Council
  - Grain Growers
  - NQ Bulk Ports
  - Halls Creek Shire Council – Upgrade options to Duncan Road and Buntine
  - MLA
- Add a predictive capability
  - e.g. Freight task for future grain and livestock forecasts
- Extension to broader freight transport
- South East Asia – ACIAR, DFAT
Visualisation Tool
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