TRAnsport Network Strategic Investment Tool (TraNSIT)
Logistics tool for mapping freight movements

Stephen McFallan – CSIRO
Presentation IPWEA Q NQ Branch Conference 2016

18 August 2016
Outline

- Overview of TraNSIT
- Informing $100m northern Australia beef roads
  - NQ examples
- Broader applications and future extensions

CSIRO TraNSIT team

- Andrew Higgins, Stephen McFallan, Matt Beaty
- Luis Laredo, Caroline Bruce
- Oswald Marinoni, Adam McKeown
- Peter Stone, Chris Chilcott
TraNSIT—Simulation of All Cattle Transport Movements
What is TraNSIT

A modular transport network analysis tool

Calculates transport and associated costs

- Initially developed to model northern Australia beef logistics
- Ground up road and rail transport costing model
- Includes associated costs: food losses; driver fatigue; etc

Transport Network Strategic Investment Tool – TraNSIT

- Infrastructure investment could reduce costs but no way previously to holistically evaluate best options
Optimises every vehicle movement

- Maps and optimises every vehicle movement
- Across the supply chain - farm – storage - processing – market
TraNSIT - Engaging Local Skills and Insights

Government

- Brought together key players – multiple departments
- *Opened doors to vital information and knowledge*
- *Government regulations clarity*

Industry

- Commitment from large enterprises across the supply chain
- *Validation and refinement*
  - *Industry practices*
  - *Driver behaviour*
  - *Network conditions and preferences*
Kununurra Beef Roads Forum

- Brought together industry and Government

- Provided significant insights into the transport challenges of North Western Australia
What's behind TraNSIT

**Commodity modules**
- location of properties, feedlots, processors, storage, ports, supermarkets, etc.
- demands or supply from enterprises
- profile of movements between enterprises

**Transport network**
- road, rail
- Vehicle and cost model

**Scenarios**
- Infrastructure
- Regulatory

**Output module**
- Cost of transport by:
  - Road segment
  - Enterprise
  - Location
  - Transport

TraNSIT Engine
TraNSIT – supply chain to movements

### Beef and Sheep
- Property
- Saleyard
- Feedlot
- Rail Point
- Abattoir
- Supermarket
- Export Depot
- Port

### Dairy
- Property
- Milk Factory
- Dairy
- Distribution Centre
- Supermarket
- Cheese Factory

### Grains
- Paddock
- Storage
- Feedlots or Feed mills
- Livestock enterprises
- Flour mills
- Storage at Port
- Road and Rail

### Sugar
- Paddock
- Sugar Mill
- Domestic consumption
- Road only
- Road and Rail
- Storage at Port

### Additional Products
- Cotton
- Pigs
- Rice
- Buffalo
- Poultry
- Apples
- Bananas
- Broccoli
- Carrots
- Lettuce
- Mandarins
- Mangos
- Melons
- Onions
- Oranges
- Pears
- Pineapples
- Potatoes
- Pumpkins
- Mixed loads
- Timber

---

*CSIRO*
**Components**

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

**Vehicle**
- Types
- Costs, speed limits

**Policy**
- Driver fatigue
- Vehicle access

**Calculation**
- Vehicle route optimisation

---

<table>
<thead>
<tr>
<th>Type</th>
<th>100 km/h</th>
<th>60 km/h</th>
<th>20km/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>
</tr>
<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>
TraNSIT – Example of Road Layer Components

**Road Ranking**
- Rank 2 (Medium)
- Rank 1 (High)
- Rank 3 (Low)

**Townsville**

**Heavy Vehicle Type**
- B-Double
- Type 1 Road Train
- Single-Trailer
- Type 2 Road Train

**Speed Limit**
- 60-80km/h or more
- 80km/h or more
- 40-60km/h
- 40km/h or less

**Barriers**
- Restricted Access
- Urban Areas
- River Crossings (Bridge Limits / Lanes)
Allowable Truck Combinations

- Road Class
  - Type 2
  - Type 1
  - B-Double
- Allowable truck combinations:
  - Semitrailer
  - B-Double
  - Type 1
  - Type 2
  - Semitrailer
  - B-Double
  - Type 1
  - Type 2
  - Semitrailer
Application to Australian Livestock Transport

Base Run - Average Vehicles per Year

Approximate Number of Livestock Heavy Vehicles

Type 2 Road Train Equivalent Count
- Up to 300
- 300 to 1,000
- 1,000 to 2,000
- 2,000 to 4,000
- 4,000 to 10,000
Application to Australian Livestock Transport

Rail Component

- Rail and road feeders
Application to Australian Livestock Transport

Base Run - Average Vehicles per Year

Approximate Number of Livestock Heavy Vehicles

Type 2 Road Train Equivalent Count

- Up to 300
- 300 to 1,000
- 1,000 to 2,000
- 2,000 to 4,000
- 4,000 to 10,000
TraNSIT - Vehicle Counts - Mt Isa to Townsville

Cattle Trucks using Sections of the Road
Mt Isa to Townsville

- Flinders Hwy
- Landsborough Hwy
- Wills Development Rd
- Gregory Development Rd
- Kennedy Development Rd
- Hann Hwy
- Aramac - Torrens Creek Rd
- Flinders Hwy
- Barkly Hwy
- Marian St (Mount Isa)
- Barkly Hwy (Cloncurry)
- Flinders Hwy (Cloncurry)
- Flinders Hwy (Julia Creek)
- Flinders Hwy (Kikimond)
- Flinders Hwy (Hughenden)
- Flinders Hwy (Prairie)
- Flinders Hwy (Toorsen Creek)
- Flinders Hwy (Rivendell)
- Flinders Hwy (Homestead)
- Flinders Hwy (Charles Towers)
- Flinders Hwy (Townsville)

Legend:
- Type 2 Road Train - East Bound
- Type 2 Road Train - West Bound
- Type 1 Road Train - East Bound
- Type 1 Road Train - West Bound
- B Double - East Bound
- B Double - West Bound
- Town Flag
- Highway Flag
Types of Scenarios

- Road or bridge upgrade
- New facilities
- Impact of disruption to network
- New infrastructure for road trains
- Improved rail facilities
  - e.g. combined with spelling yard or tick clearing
  - Optimal location of loading points
- New road links
  - e.g. bypass roads
- Regulatory changes

Photo: ABC News: Melinda Howells

TraNNSIT

Photo: ABC News: Melinda Howells
System interruption (Mitchell Highway Closure)

- Detour via St George and Roma adds another 552km to trip
- Charleville – Bollon detour (extra 144km) not suitable during wet weather
- Expected cost of detour to livestock industry during September is $230,000 – not including interstate movements

Photo: ABC News: Alyse Edwards)
Northern Beef Transport - Issues

Vulnerable to market and climate disruptions
- Transport access and costs are a major driver

Long Supply Chains
- Often over 1000km to abattoir or live export
- Transport costs up to 35% of market price
- Confounded by vehicle accessibility and driver/animal regulations

Infrastructure investment could reduce costs
TraNSIT can be used to holistically evaluate investment options
Application to $100 Beef Roads Programme

- Northern Australia White Paper Initiative
  - TraNSIT estimate transport cost savings for submissions
  - Informs Government where to focus investment

- 60 road upgrade submissions
  - 40 in Queensland, 10 in NT, 6 in WA + others
  - Estimate cost of all upgrades was about $3 billion
  - Upgrades included: sealing of unsealed roads, widening roads, bridges, higher productivity vehicles, last mile
  - Results presented at Beef Roads Round Table Darwin 9th March
Scope of Transport Costs

- Currently included for Beef Roads Programme
  - Travel costs for each type of vehicle and travel time
  - Decoupling
  - Stoppages for driver rests and for loading/unloading

- Future versions of TraNSIT will include
  - Savings to other road users
  - Effect of unsealed or narrow sealed roads on maintenance
  - Reduced slowdown and acceleration from passing
<table>
<thead>
<tr>
<th>Description</th>
<th>Annual savings ($)</th>
<th>Annual Trailers</th>
<th>Trailers after upgrade</th>
<th>Savings per Head ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 2 access Morven to Charleville, currently type 1</td>
<td>$ 282,156</td>
<td></td>
<td></td>
<td>$ 2.69</td>
</tr>
<tr>
<td>Type 1 access Biloela to Gladstone</td>
<td>$ 87,858</td>
<td>920</td>
<td></td>
<td>$ 0.92</td>
</tr>
<tr>
<td>Upgrade to Panorama Crossing, near Rolleston, raise bridge for reduced flooding</td>
<td>$ 44,886</td>
<td>1524</td>
<td></td>
<td>$ 1.22</td>
</tr>
<tr>
<td>Upgrade to Burnett Highway (Type 1)</td>
<td>$ 218,689</td>
<td>3640</td>
<td>6088</td>
<td>$ 1.18</td>
</tr>
<tr>
<td>Peninsula Development Road - unsealed sections</td>
<td>$ 19,444</td>
<td>146</td>
<td>148</td>
<td>$ 1.44</td>
</tr>
<tr>
<td>Savannah Way (Doomadgee to Burketown) sealing</td>
<td>$ 37,882</td>
<td>914</td>
<td>962</td>
<td>$ 1.14</td>
</tr>
<tr>
<td>Cloncurry to Dajarra road - sealing remaining sections</td>
<td>$ 174,788</td>
<td>886</td>
<td>4640</td>
<td>$ 1.15</td>
</tr>
<tr>
<td>Hann highway</td>
<td>$ 162,126</td>
<td>2038</td>
<td>2786</td>
<td>$ 1.30</td>
</tr>
</tbody>
</table>
Queensland Example – Cloncurry to Dajarra Road

Map showing the route from Mount Isa to Cloncurry to Dajarra.
### Queensland Example – Cloncurry to Dajarra Road

<table>
<thead>
<tr>
<th></th>
<th>SAVINGS PER ANNUM</th>
<th>TRAILERS PER ANNUM</th>
<th>TRAILERS AFTER UPGRADE</th>
<th>SAVINGS PER HEAD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel</td>
<td>$129,962</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vehicle break down</td>
<td>$1,534</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Broader network</td>
<td>$43,291</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$174,788</strong></td>
<td>886</td>
<td>4640</td>
<td><strong>$1.15</strong></td>
</tr>
</tbody>
</table>
Queensland Example – Collinsville to Belyando Crossing road
Queensland Example –
Collinsville to Belyando Crossing road

<table>
<thead>
<tr>
<th></th>
<th>SAVINGS PER ANNUM</th>
<th>TRAILERS PER ANNUM</th>
<th>TRAILERS AFTER UPGRADE</th>
<th>SAVINGS PER HEAD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel</td>
<td>$82,342</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vehicle break down</td>
<td>$2,721</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Broader network</td>
<td>$12,889</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$97,953</strong></td>
<td>300</td>
<td>1064</td>
<td><strong>$3.16</strong></td>
</tr>
</tbody>
</table>
Queensland Example – Collinsville to Belyando Crossing road
Queensland Example – Ootann road

Change
- Class Upgrade
- Class Upgrade & Upgrade
- Class Upgrade, Surface & Widening
- Class Upgrade, Surface, Widening & Upgrade
- Surface, Widening & Upgrade
Queensland Example – Ootann road

<table>
<thead>
<tr>
<th></th>
<th>SAVINGS PER ANNUM</th>
<th>TRAILERS PER ANNUM</th>
<th>TRAILERS AFTER UPGRADE</th>
<th>SAVINGS PER HEAD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel</td>
<td>$60,130</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vehicle break down</td>
<td>$4,570</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Broader network</td>
<td>$23,643</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>$88,343</td>
<td>51</td>
<td>367</td>
<td>$7.83</td>
</tr>
</tbody>
</table>
Queensland Example – Ootann road
Developments and Applications

- Informing northern Australia $100 million roads fund
  - Northern Australia White Paper project
  - Identify infrastructure and policy investments with greatest transport cost savings
  - Work completed this year

- Application of TraNSIT to broader Australian Agriculture
  - Agriculture Competitiveness White Paper project
  - Around 25 commodities or >95% of transport volume of Australia agriculture
    - Validation stage for sugar, cotton, grains, pigs, rice, diary, bananas, poultry, canola, apples, grapes, and a range of horticulture crops
  - Identify pinch-points and bottlenecks
  - Test infrastructure/policy scenarios to reduce transport costs
Agriculture White Paper Initiative

- Adapt to over 25 commodities
  - 95% of Australian agriculture volume transported
  - 85% of gross farm gate value ($43 billion)
  - Widespread industry consultation

- Progress
  - Beef, sugar, grains, dairy, cotton, pigs, rice, horticulture
  - 127 million tonnes transported from origin to destinations
  - Over 5 million vehicle trips and 15,000 rail trips routed
  - Rail incorporated for beef, grains, cotton and sugar
  - 400,000 supply chain paths

- Scope
  - Trips to properties, storage, processing, export, DCs, retail
Application to Australian Agriculture Transport

Average Vehicles per Year

All Commodities

TRAILER COUNT
1
5,000
120,000

beef, grains, pigs, dairy, cotton, rice, sugar

DRAFT
Summary and Future Developments

- Largest and most detailed transport optimisation tool ever built for agriculture
  - Over 200,000 enterprises and 400,000 supply chain paths
- Predicts knock-on impacts across entire freight network
  - From infrastructure investments
  - From future growth and production scenarios
- Extension to broader freight transport
- Linking climate/weather forecasts with transport movements
- Application in South East Asia
  - Beef and horticulture transport in Vietnam, China, Laos
For further information contact

Andrew Higgins
CSIRO Land and Water
07 3833 5738
Andrew.Higgins@csiro.au


Co-investment by

[Logos of Office of Northern Australia, MLA, Queensland Government, Northern Territory Government, and Government of Western Australia]