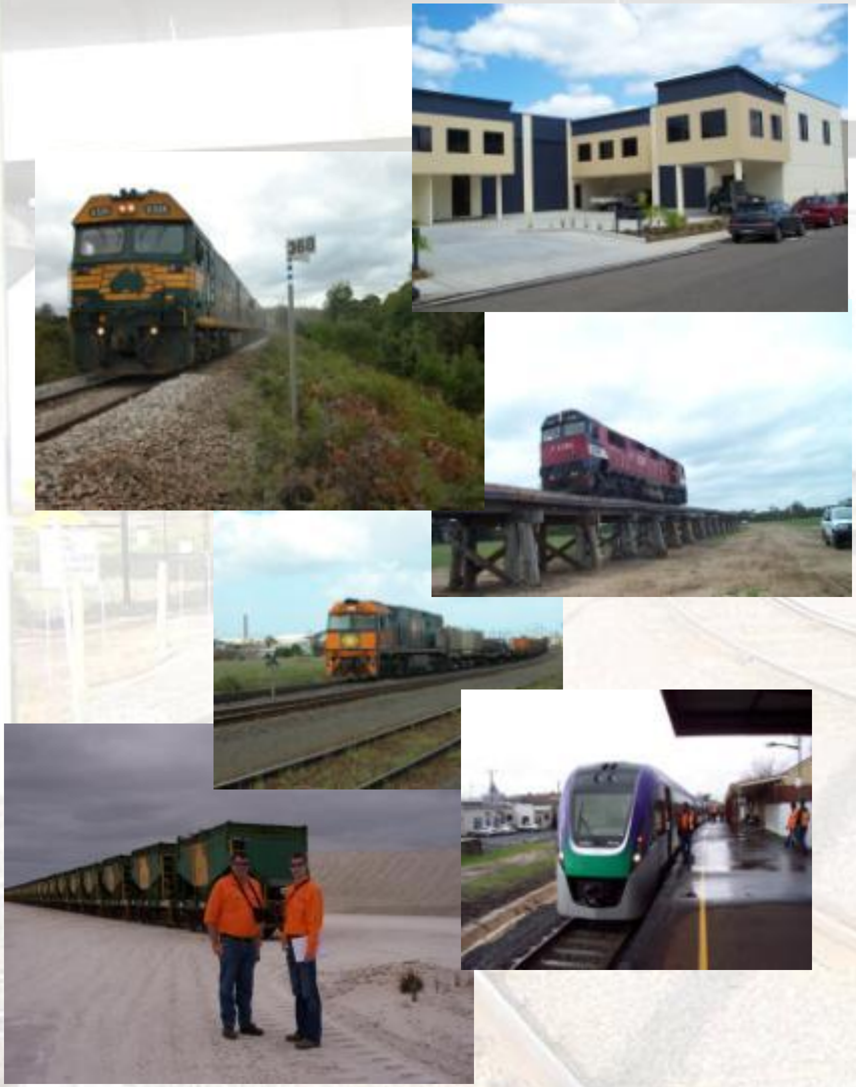
Plateway

Modelling of Service Reliability Using OpenTrack

IT 08 Closing the Loop - Capacity and Quality of Railway Systems January 2008

Corporate Background



Plateway Pty Ltd
6/3 Sutherland Street
Clyde NSW 2142
Australia

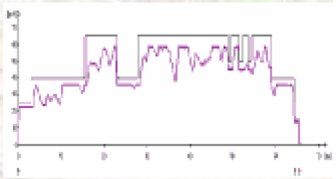
Phone: +61 2 9637 5830
Fax: +61 2 9637 6350

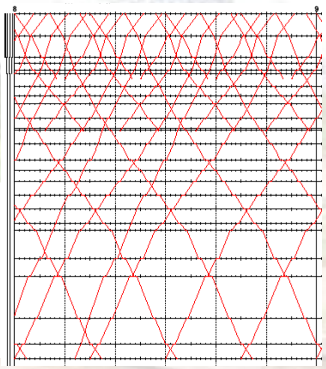
Phillip Imrie
B.E. (Civil) Hons 1, M.B.A.

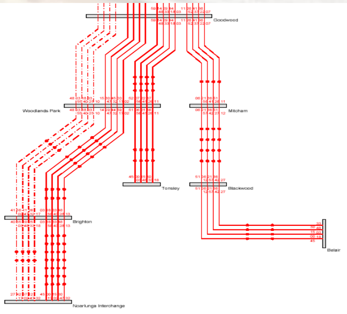
Plateway

Plateway Capability

- Financial Assessment of Railway Operations and Projects
  - Project economic evaluations and cost/benefit analysis
  - Value management studies
  - Due diligence
- Railway Service Design
  - Single train simulation using OpenTrack
  - Railway network simulation using OpenTrack
  - Timetable design using Viriato
  - Haulage system capacity
- Management System Development
  - Development of Railway Safety Management Systems
  - Railway safety audits
  - Risk assessments







Plateway

Plateway Capability

- Railway Management Service
  - Project management
  - Tendering and estimating
  - Contract management
  - Contract strategy selection
  - Contract performance assessment
- Railway Engineering
  - Technical standards and requirements assessments
  - Reliability analysis
  - Asset condition and assessment
  - Work program development
  - Infrastructure and rollingstock acceptance testing
  - Terminal design

Reliability – Why Bother?

- Cost base – infrastructure, rollingstock.
- Asset utilisation.
- Market share particularly for high value time sensitive freight.
- Network Connectivity

Reliability Modelling with OpenTrack

- System View (Monte Carlo Function)
  - Good approach for testing timetable when you do not care what is driving the causes of poor reliability.
  - Useful for evaluating whether a service design on a given infrastructure can meet the required level of on time running performance.
  - Historical data set does not discriminate between cause and consequence.

Reliability Modelling with OpenTrack

- Incidents View
  - Test the impact of a discrete data set.
  - Quite often the railways engineering data set (rollingstock failures, TSR records, signal failure records align better with this view).
  - Historical data set does discriminate between cause and consequence.

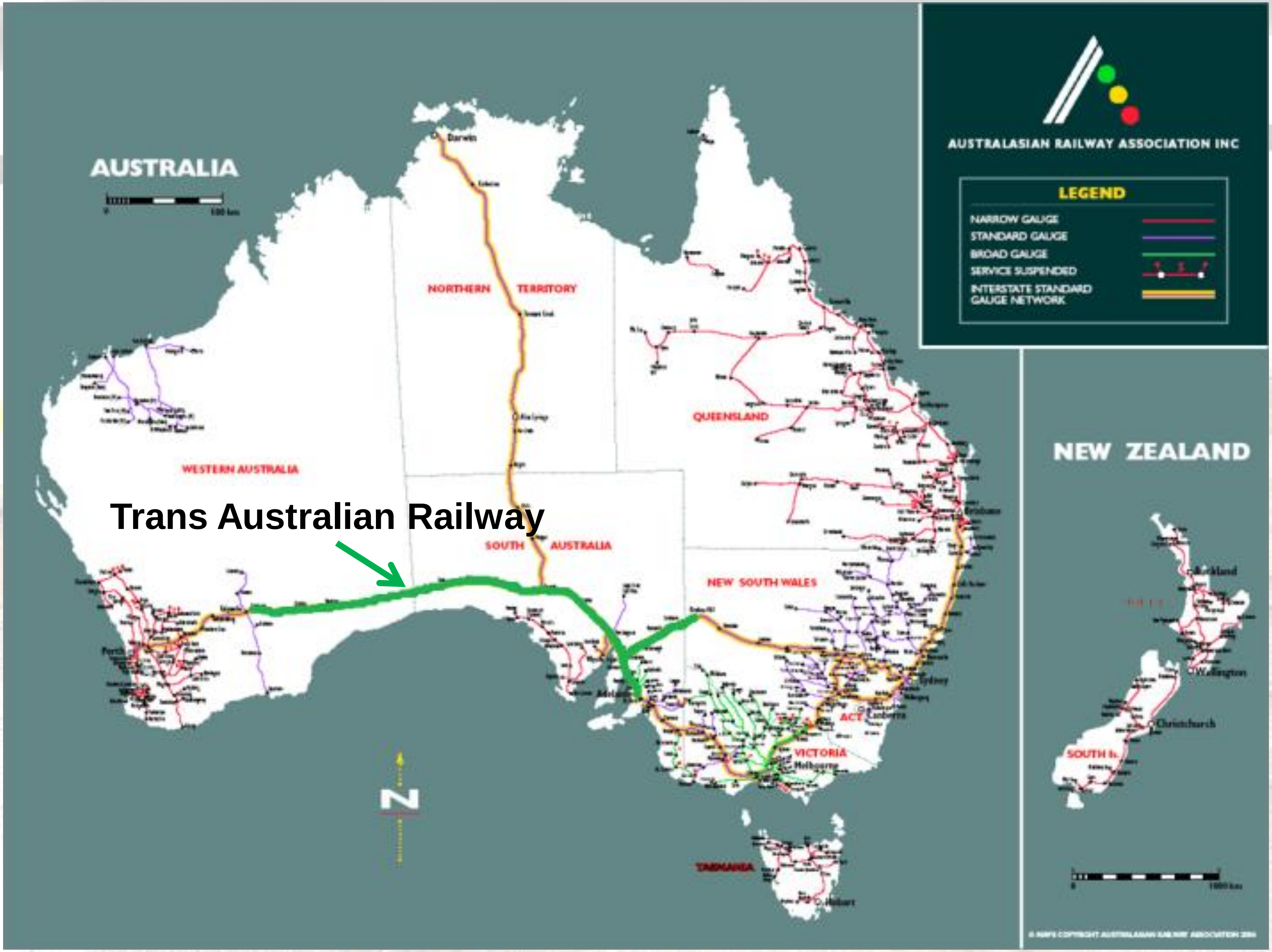
Basic Premise

- We can describe system happening on a railway mathematically using a series of probability distributions which describe the probability of failure of an element (such as signals, terminal despatch of trains.
- These are generated randomly.
- Entered into OpenTrack as incidents.

Basic Premise

- OpenTrack software can calculate the consequences on a network wide basis for each total incident data set.
- These can be calibrated against the historical data set.
- Consequences should correlate with the historical data set.
- Variable analysis can be used to test the impact of changing each chosen distribution and the resulting benefits to the rail service.

Australian Railway Network



Australian Railway Network

- Interstate Network is Around 9,400km in length.
- Connects all state capital cities with a uniform gauge (1,435mm).
- Started in 1912 (first major section opened in 1917) and completed in 1995 (or 2004 if Darwin is included).

Australian Railway Network

- Maximum train speed of 115km/h (parts up to 160km/h).
- Maximum train length of 1,800m.
- Maximum axle load of 25 tonnes.
- West of Adelaide/Parkes double stacking permitted.

Australian Railway Network

- Open Access managed by four major access providers.
- Currently one large freight operator, several small freight operators and state based passenger services.
- Volume of rail traffic varies along the east west corridor from 5MGT p.a. to 22MGT p.a.
- Other portions include sections of up to 120MGT p.a.

Plateway

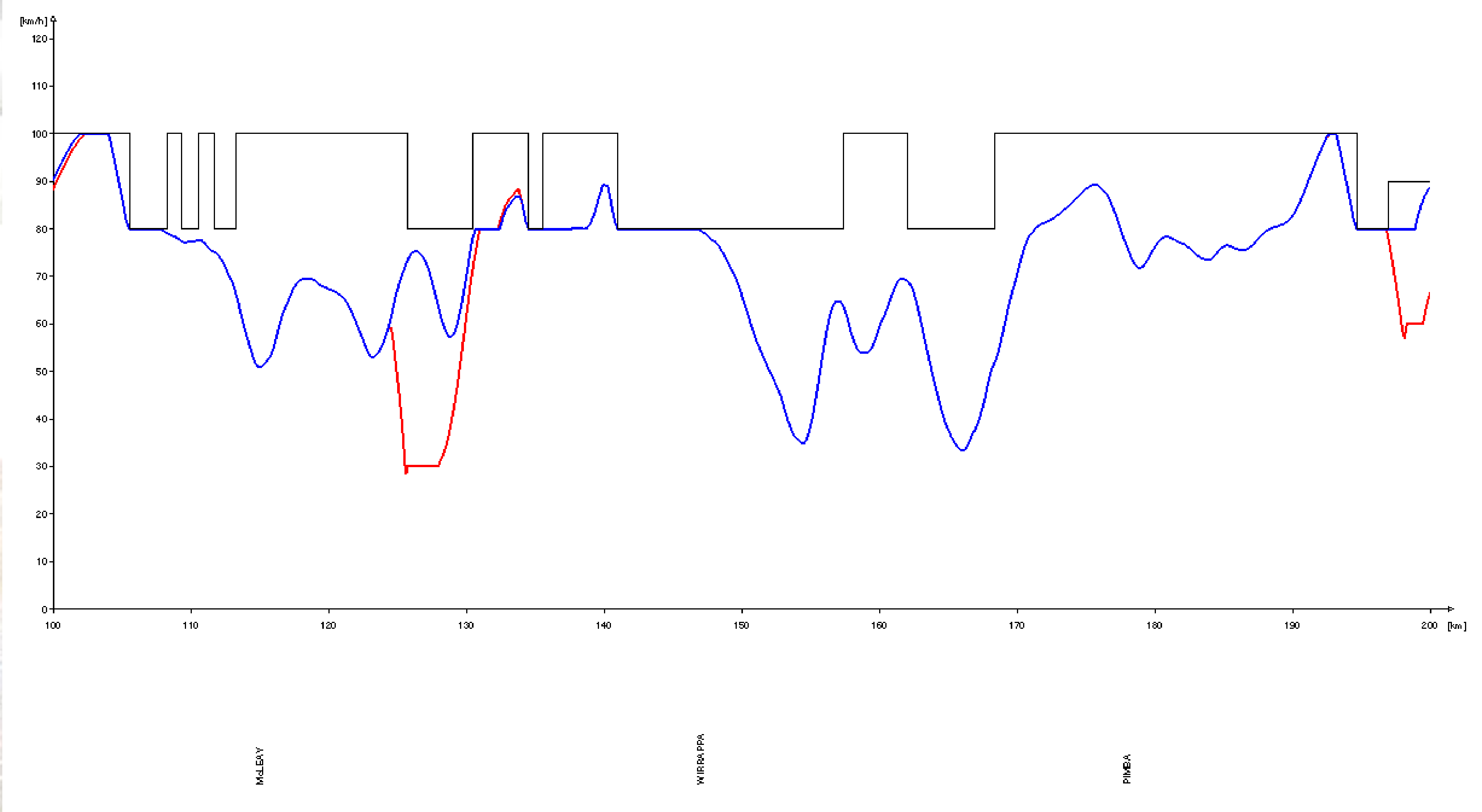
OpenTrack the “Virtual Railway”

- Pacific National OpenTrack model was started in 2003 and covers all of the Interstate Rail Network (excl. Tarcoola – Darwin), with a total route length of in excess of 9,000km.
- The model is populated from an access seekers perspective using data provided by the network owner to all access seekers.
- Originally developed to test the benefits of funding proposals generally in ‘single train’ mode.

OpenTrack the “Virtual Railway”

- Single Train Simulations
  - Measurement of TSR impact Adelaide – Parkeston (monthly).
  - Time benefits of main south infrastructure upgrades.
  - Capability of North – South route options (for DOTARS study).

OpenTrack the “Virtual Railway”



OpenTrack the “Virtual Railway”

- Multi Train Simulations
  - Moss Vale – Unanderra & Illawarra Bulk Terminal.
  - South Sydney Freight Line & Metropolitan Goods Line.
  - North Coast loop extensions (both 1,500m & 1,800m).
  - Reliability modelling Adelaide – Parkeston.

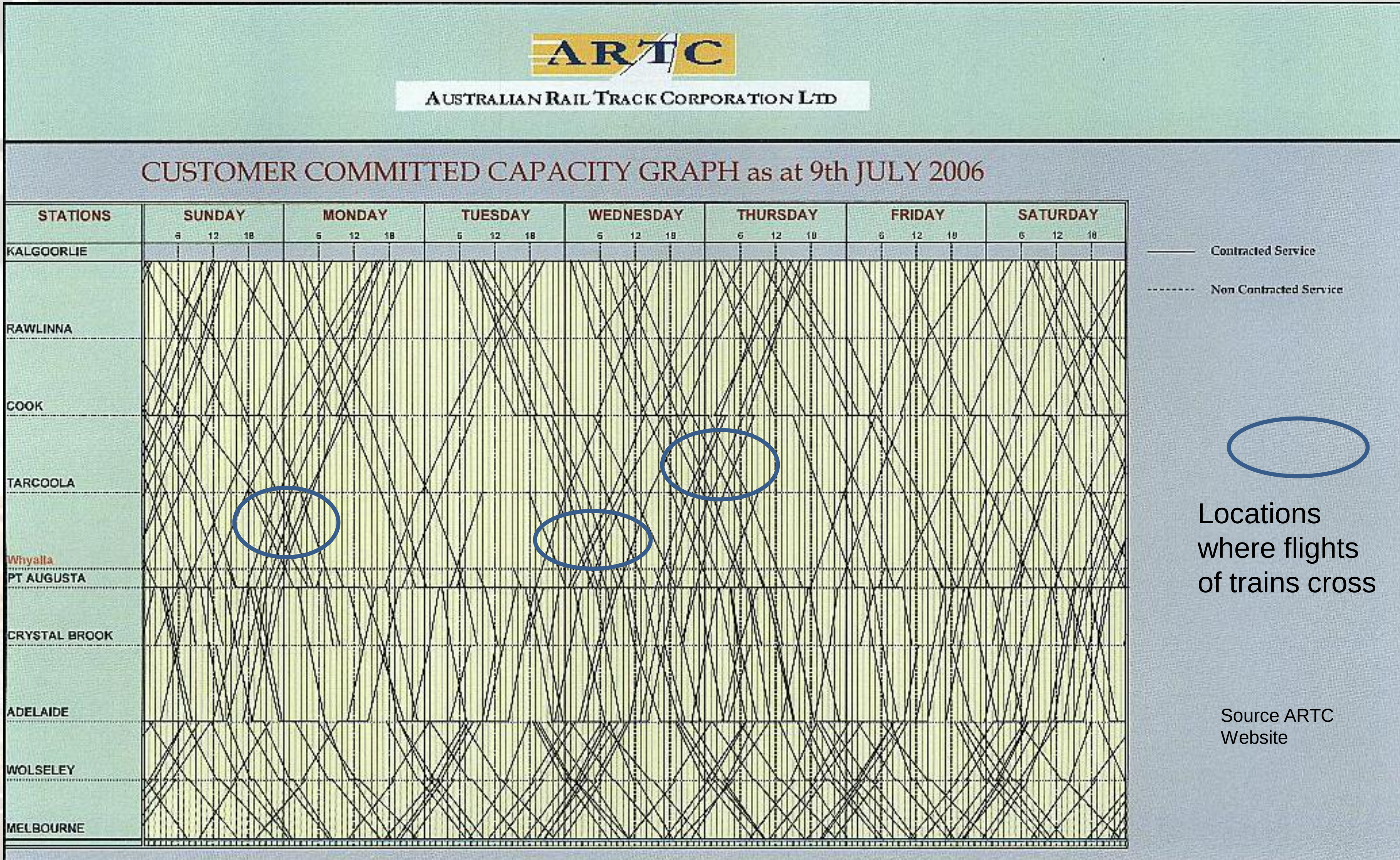
East West Study

- Railway Line runs through an uninhabited landscape.
- Fuelling at Cook and Parkeston acts as capacity limiters.
- Historically a section with high reliability assets.
- Timetabled Transit Time Adelaide – Parkeston:
  - Express Freight 24:15
  - Passenger 24:20
  - Standard Freight 40:15

East West Study

- Market Demand creates flights of trains heading west or east.
- Between those flights the corridor has surplus capacity.
- Market growth causes additional trains to be added to a given sequence of flights (i.e. the number of flighted trains increases).

East West Study



Locations where flights of trains cross

Source ARTC Website

East West Impact of Growth

- Additional train services.
- Train Services have a higher loading and are longer.
- Less available maintenance windows.
- Trains no longer originate from the same terminals.
- Trains no longer all fuel at Cook and Parkeston.

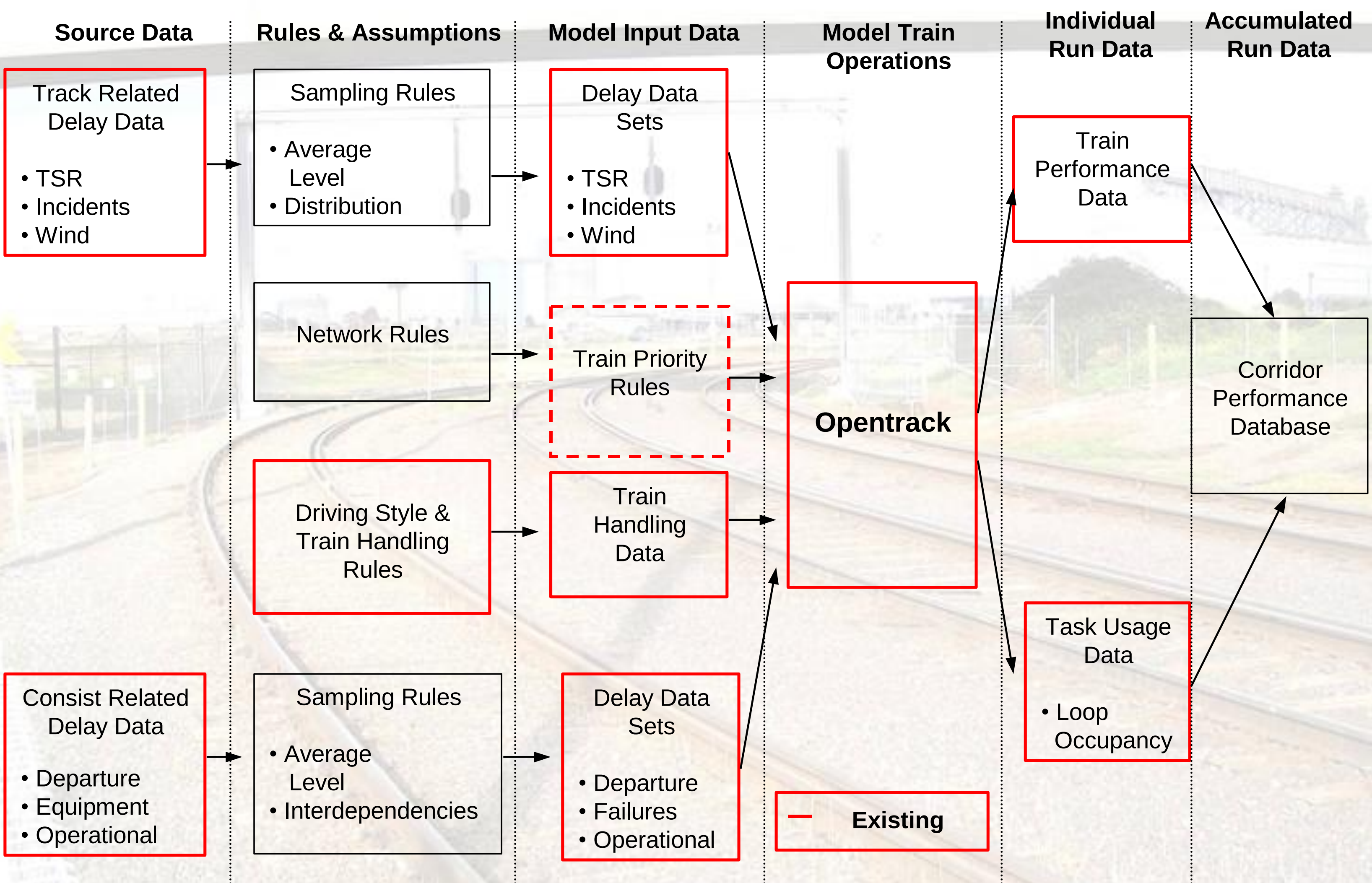
East West Model

Section	Route Km	Crossing / Block Locations
Adelaide - Parkeston	1900	55 + 22 km of double line
Crystal Brook – Broken Hill	373	14

- Trains run over 11 days of simulation
  - 173 Courses, with individual train consists
- Typical Incident Data Set
  - 70 - 100 Incidents

Model Structure

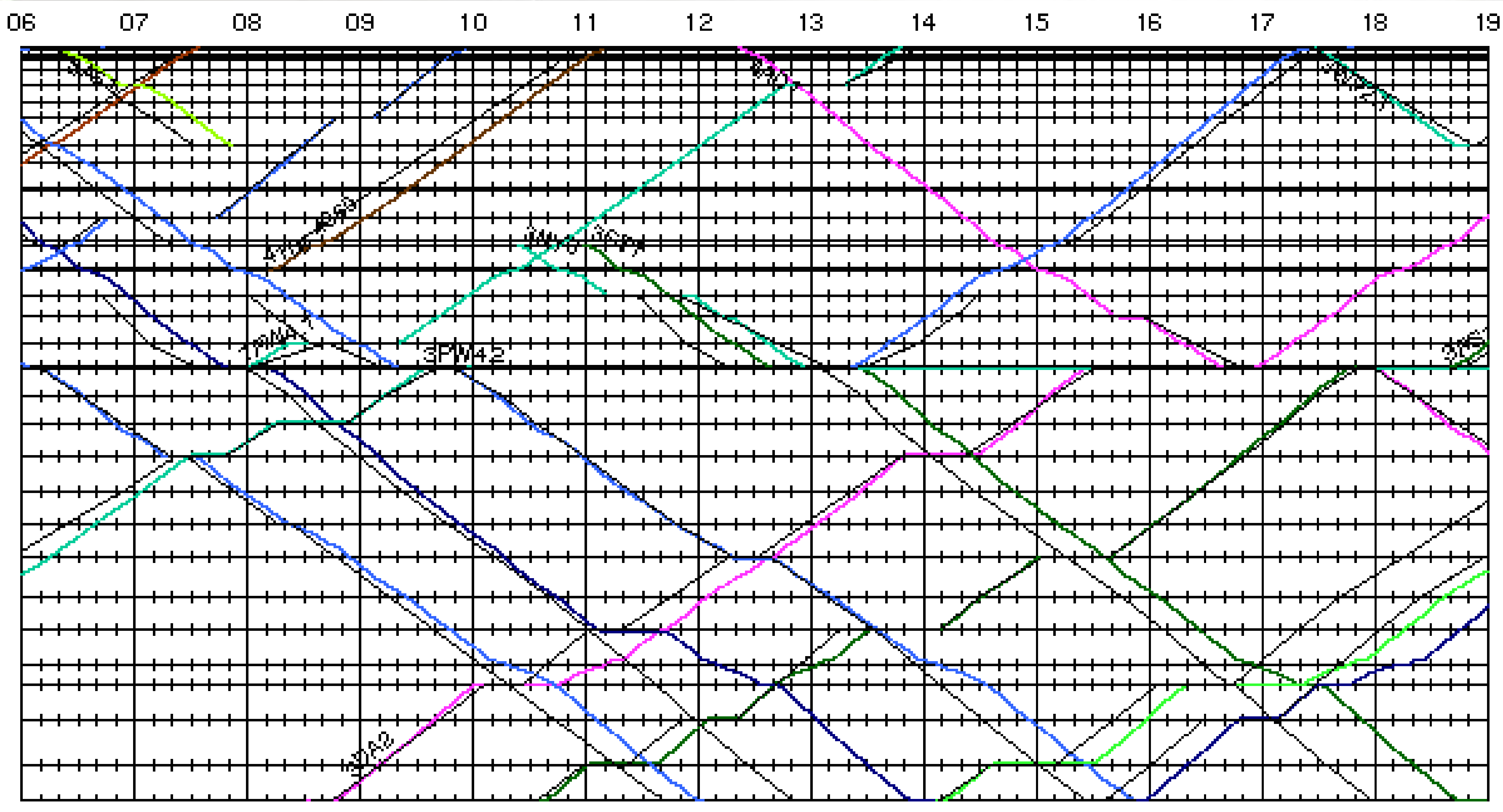
Model Structure



Outcomes

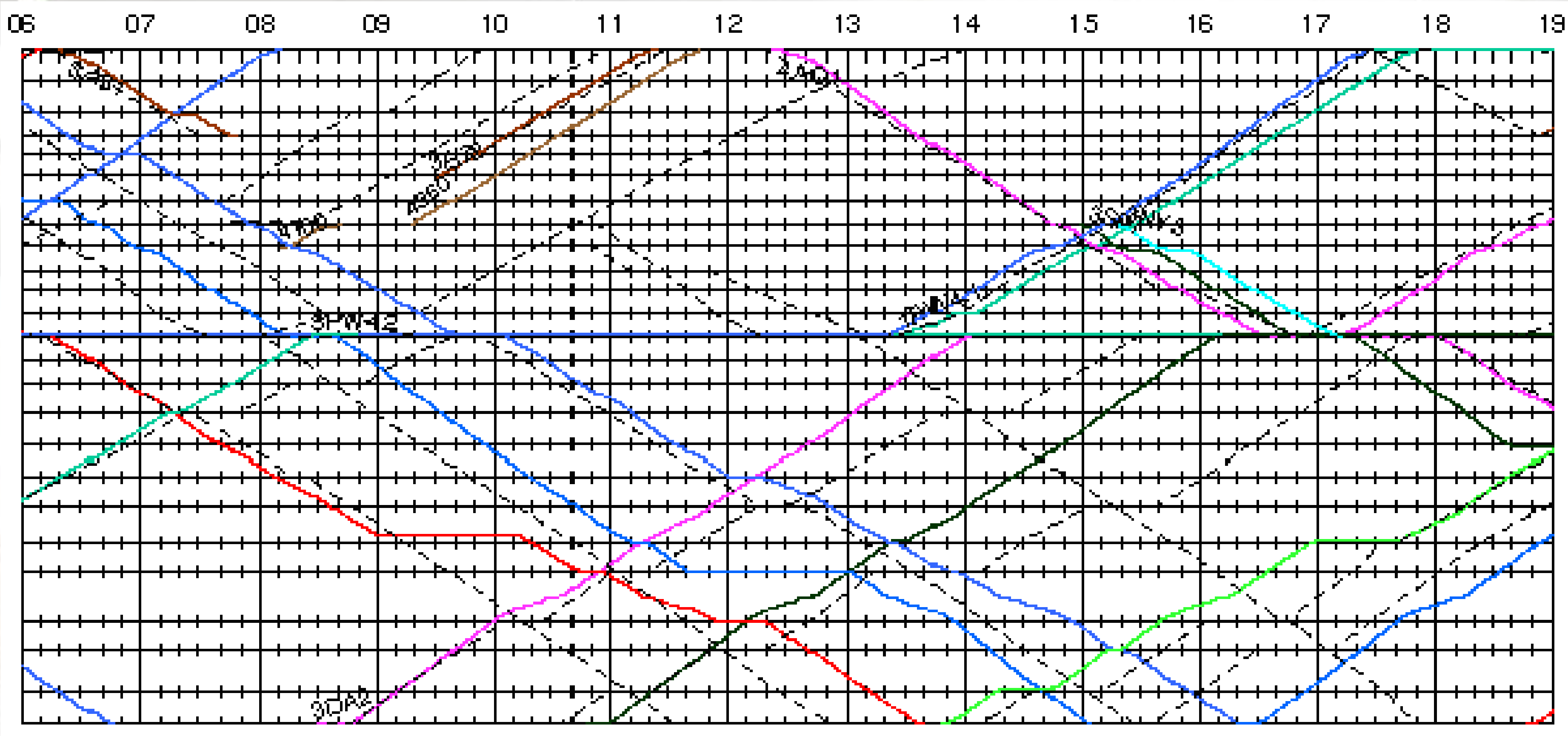
- Model Outputs are consistent with historical data set.
- Identification of the benefits to the service of changes to:
  - Temporary speed restrictions;
  - Below rail incidents;
  - Rollingstock reliability;
  - Terminal performance; and
  - Rollingstock performance by adding locomotives.

Impact of Incidents



Simulation with Temporary Speed Restrictions Only

Impact of Incidents



Simulation with Temporary Speed Restrictions Plus Incidents

Outcomes

- Trains ‘bunch’.
- Extended waiting time in crossing loops.
- Reliability Drivers:
  - Some factors driving reliability affect every train such as:
    - Climatic effects (these can be described mathematically); and
    - Condition related temporary speed restrictions.
  - Others are random events.

Outcomes

- Improvement in factors affecting every train (higher power to weight ratio & less TSRs) costly but allow system to ‘recover’.
- Improvement in random events:
  - May be difficult to achieve is a sustained manner;
  - Will always leave a small population of random events; and
  - Requires system re-engineering.

Commercial Issues

- Who “owns” the recovery time and ability to recover in the schedule? The operator or Network Access Provider?
- How are investments to improve reliability across the system funded?
- What is the Network Access providers role in optimising the system?

Acknowledgements

Pacific National/Asciano Corporate Group

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