Intermodal Terminals and their networks

- Rail perspectives -

Sydney as a case study

Overview

- History and background
- Map
- Targets, trends and determinants
- Demand
- Urban systems and capacities
  - *Port interface, IMT's, empty containers*
- Value chain perspectives
  - *Activity costs, transactions, and non-financial perspectives*

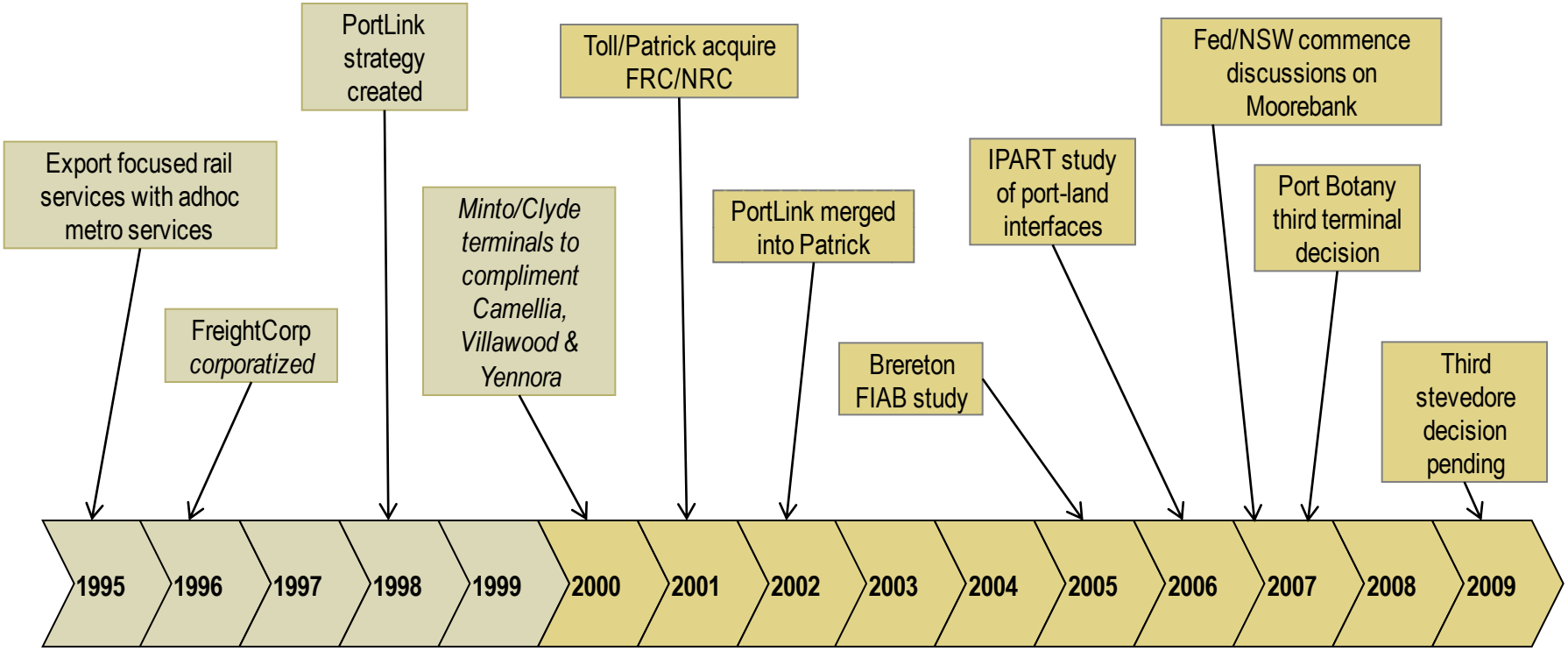
Experience

- Managed road fleets and warehouses for Linfox, PGA Logistics, ICI and Allied Pickfords
- General Manager Freight Services, FreightCorp
  - *Architect for PortLink*
- Consultant
  - *Strategic, economic and operational advice in port-land systems – all states*
  - *Freight Infrastructure Advisory Board (NSW)*
  - *Input into Freight Futures, Port@L strategy and*

Key proposition

- Developing and implementing intermodal operations to service port-metro demand is hard
- The debate and analysis tends to be oversimplified by government and operators
- Running the train is only part of the task
- Some value chain intermediaries are not willing to commit due to threat to their business models
- The environmental and community benefits of getting it right are worth the effort

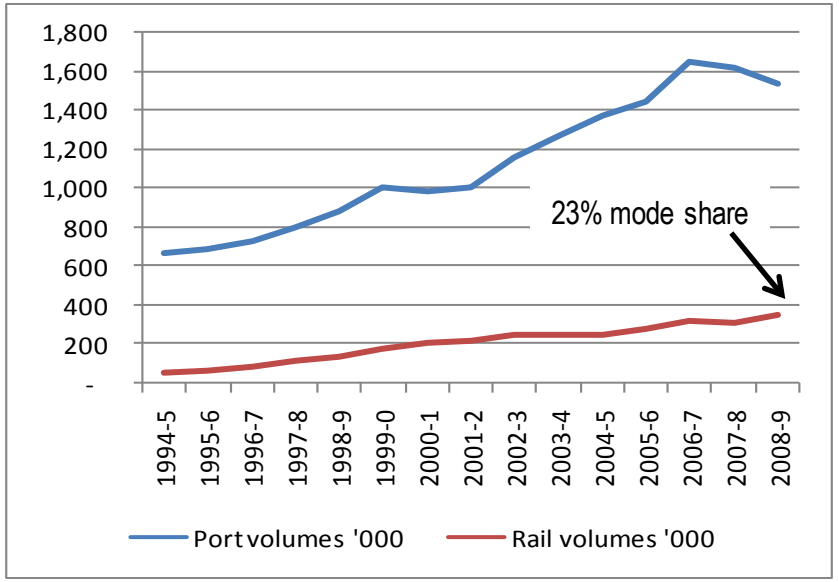
Timeline – Port metro rail developments in Sydney



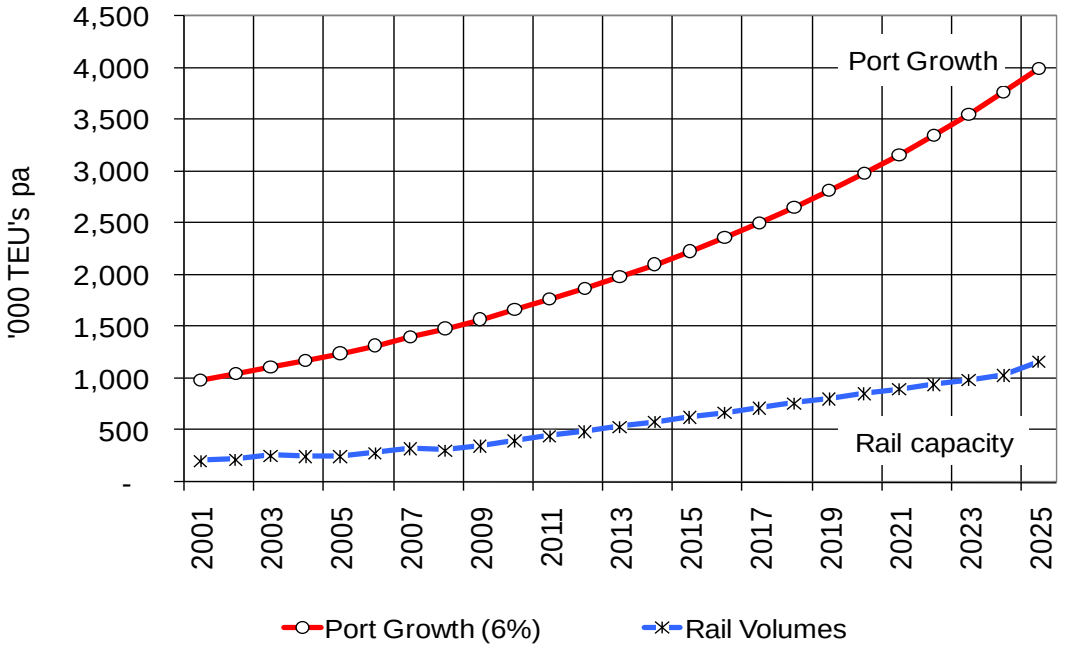
	1994-5	1995-6	1996-7	1997-8	1998-9	1999-0	2000-1	2001-2	2002-3	2003-4	2004-5	2005-6	2006-7	2007-8	2008-9
Port volumes '000	666	689	730	798	878	1,010	989	1,009	1,160	1,270	1,375	1,445	1,652	1,620	1,540
Rail volumes '000	60	70	90	120	145	185	210	220	255	250	251	280	324	309	353
% rail share	9%	10%	12%	15%	17%	18%	21%	22%	22%	20%	18%	21%	20%	19%	23%

Port growth and rail mode share - Sydney

Port and rail growth since 1994-5



Sydney Port forecast throughput at 6% CAGR and potential rail share

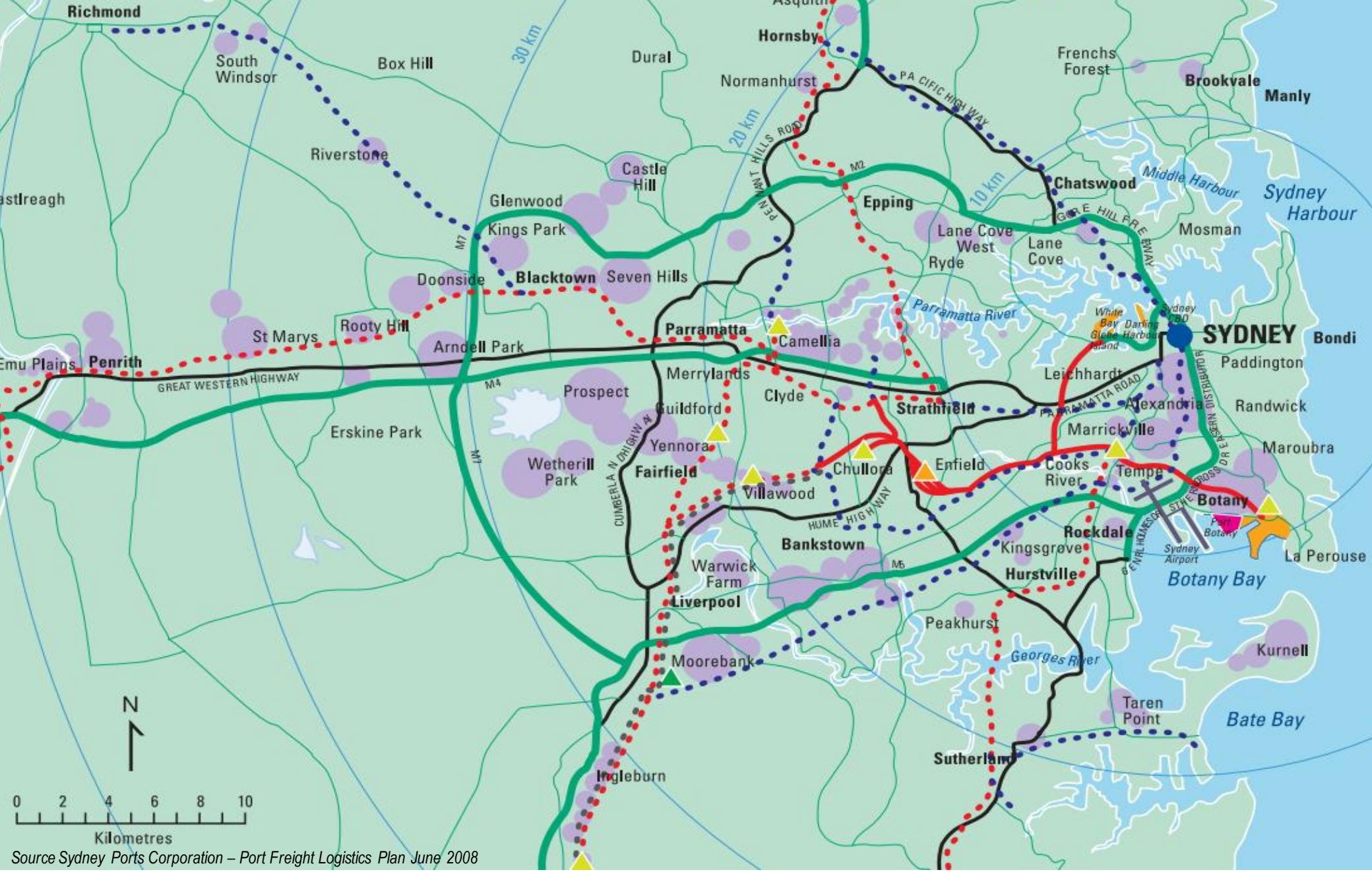


Overview of FreightCorp Strategy 1997-2001

- Identified opportunity to increase modal share in a growing market
- Need to create links between customer and train
  - *port interface dynamics had to be addressed*
- Affiliations with Port Corporation and trucking industry needed to be developed
- Sought alignment with state government policy aspirations
- Commercial and operational strategy formulated
- Terminal developments as joint operating and investment alliances
- E-Business (IBIS/Rail hub)
- Stevedore relationships
- Growth from 65,000 TEU's to 180,000 TEU's over 4 years

Sydney's IMT network

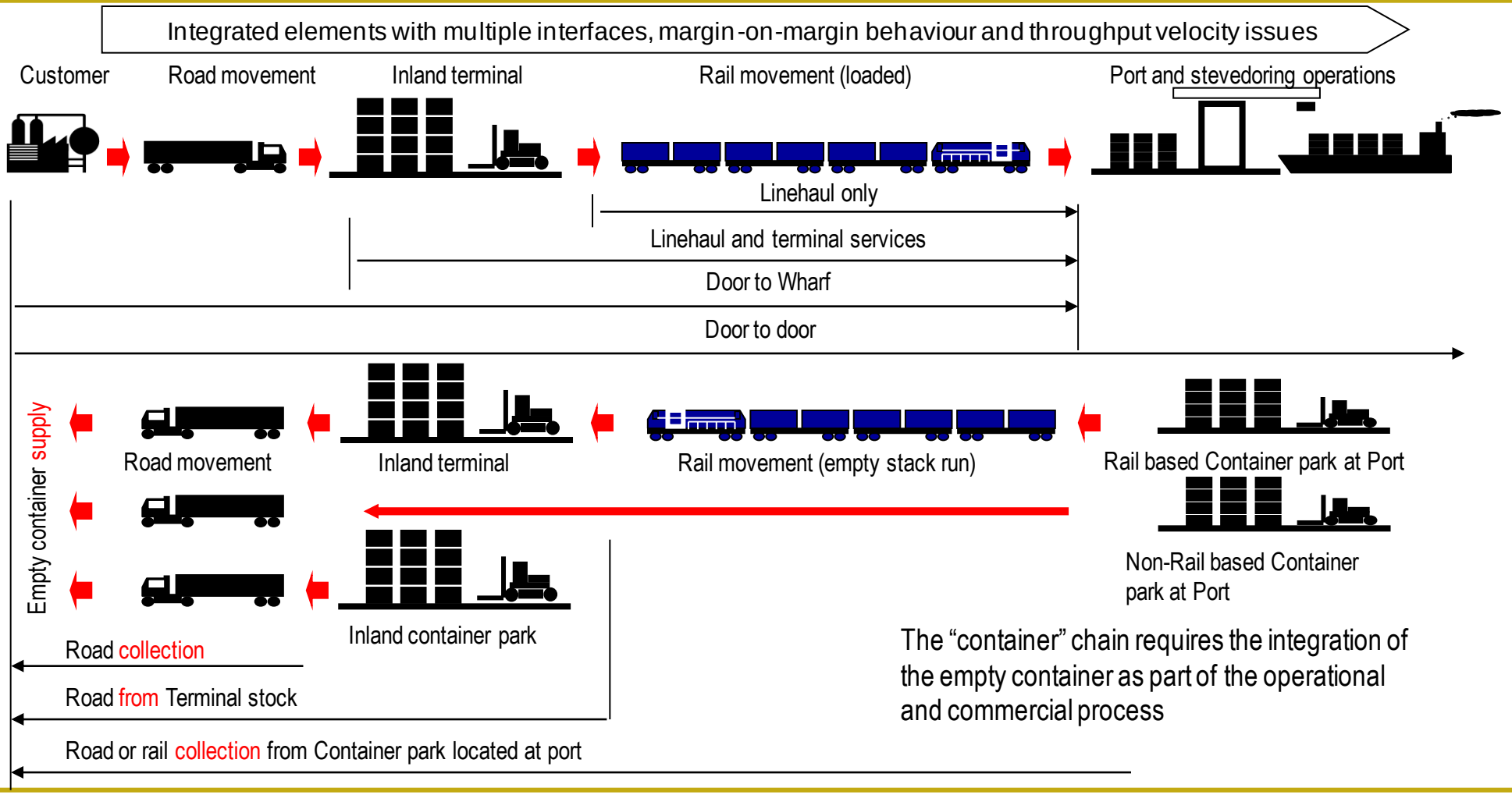
- Current
  - *Minto, Cooks River, Villawood, Camellia and Yennora*
- Emerging / Proposed
  - *Enfield and Moorebank*
- Missing terminals
  - *Eastern Creek*
  - *No IMTs west of Cumberland Highway*



Source Sydney Ports Corporation – Port Freight Logistics Plan June 2008

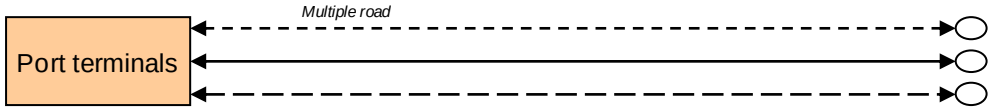
- Motorways
- Main roads
- Dedicated freight rail line
- Intermodal Terminals
- Industrial zones
- Port facilities
- Shared passenger/freight rail lines
- Dedicated passenger rail lines
- Southern Sydney Freight Line (planned)
- Enfield Intermodal Logistics Centre (planned)
- Moorebank Intermodal Terminal (proposed)
- Port Botany development area

Supply Chain elements … export by rail

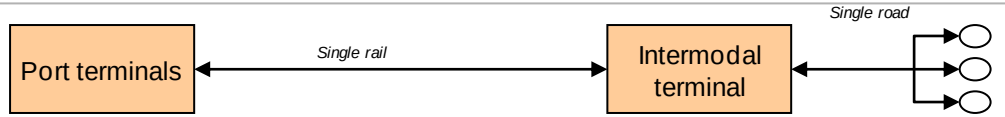


Form follows function
Supply chain models depend on business models

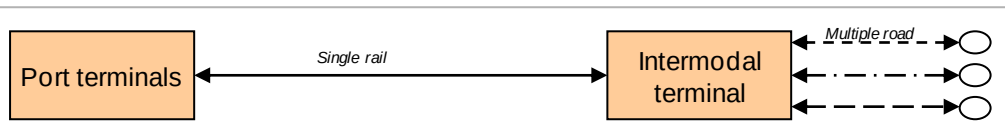
A – Road direct



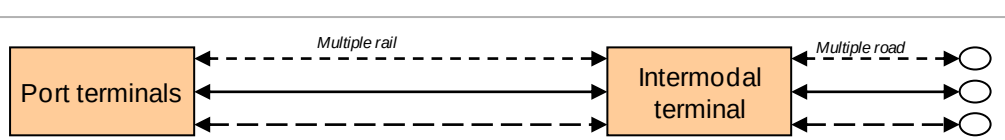
B – Simple, closed access



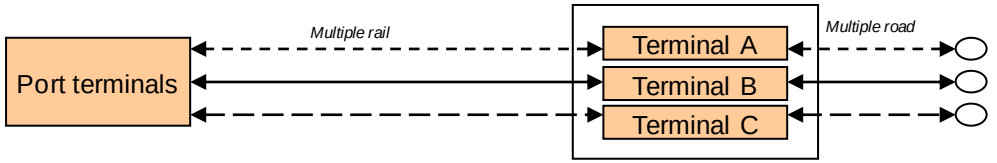
C – Simple, unlimited road access



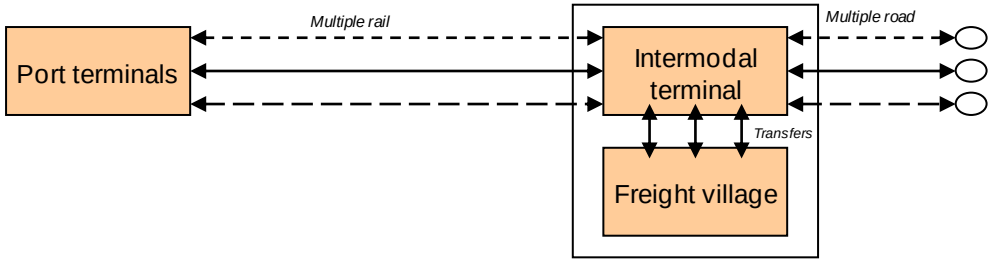
D – Open rail and road access



E – Multi user terminal; controlled access



F – Freight village with open rail and road access

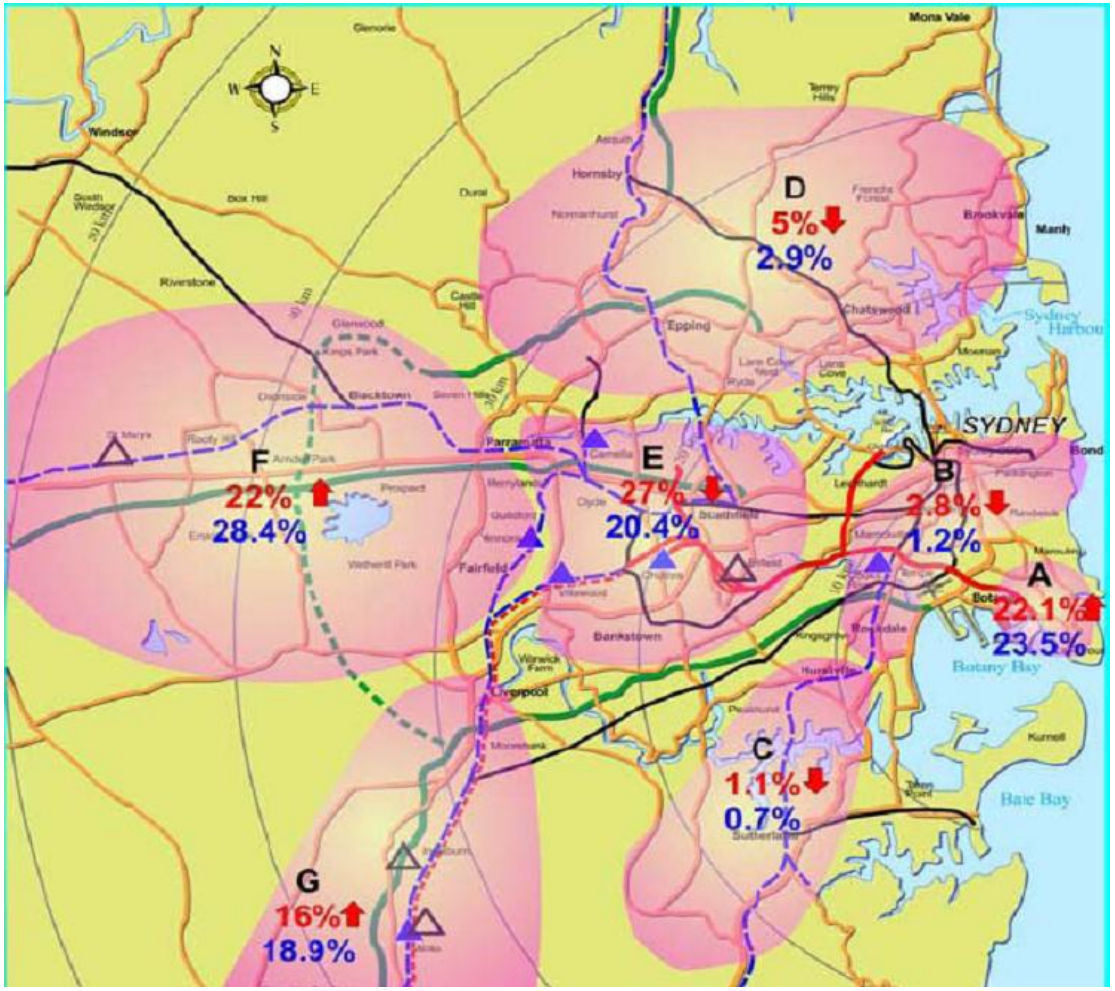


- Demand; growth / trends
- 40% aspirational target
- Determinants and implications

Task and growth trends since 1990

- Imports growth: 7.7% growth pa
  - *Full TEU's growth at 8%, whereas MT imports declining*
- Exports growth: 8.9% growth pa
  - *Full TEU's growth at 5.1%, however empty TEU's growing at 15%*
- The differential between demand for 40' imports and 20' exports is widening
- The system is import driven
  - *Empty exports = 50% of total exports*
  - *Every import becomes an empty container at some stage!*
- TEU to container ratio is 1.4 and rising
  - *Expect to be 1.6 by 2025*
- Peak month = 9% of annual throughput
  - *Whilst some "smoothing of demand has occurred, seasonality remains a significant issue.*

Forecast shifts in container movement sources and destinations



Achieving 40% modal share by rail will depend on a number of inter-related issues

- **Performance of the rail sector**
  - *Perception by the market on reliability*
  - *Separation of freight and passenger rail systems*
- **Port-rail interface**
  - *Achieve higher throughput performance and operational certainty*
  - *By 2025, Port Botany will need to handle 55-60 trains a day, and process a train every 1.6 hours*
- **Inland terminals in proximity to the "local" market**
  - *Existing terminals must continue and Enfield has a viable market*
  - *Greatest demand will be in outer west (Wetherill Park-Blacktown)*
- **Location of empty container parks to be integrated with the inland intermodal terminals**
  - *From an urban freight perspective, it is no longer acceptable to move significant volumes of empty container across Sydney by road, when the demand for import and export containers is highest in the Outer West*
- **More efficient coordination of the empty container task**
  - *Need for smarter price signals by shipping lines and to recognise the location of their market*

Demand and capacity determinants

- Demand
  - *Key determinant is growth within key areas in Sydney metro and Regional NSW*
  - *Differentials in import and export growth of trade*

- Capacity
  - *Key determinant of modal share:*
    - Capacity & location of intermodal terminals
    - Performance of rail-port interface
    - Significance of the road task
  - *Assuming port-rail issues are addressed, the long term rail capacity is limited by Enfield-Port rail corridor*
    - Between 1.2 and 1.4 million TEUs pa is sufficient to achieve more than 40% of rail share to 2020

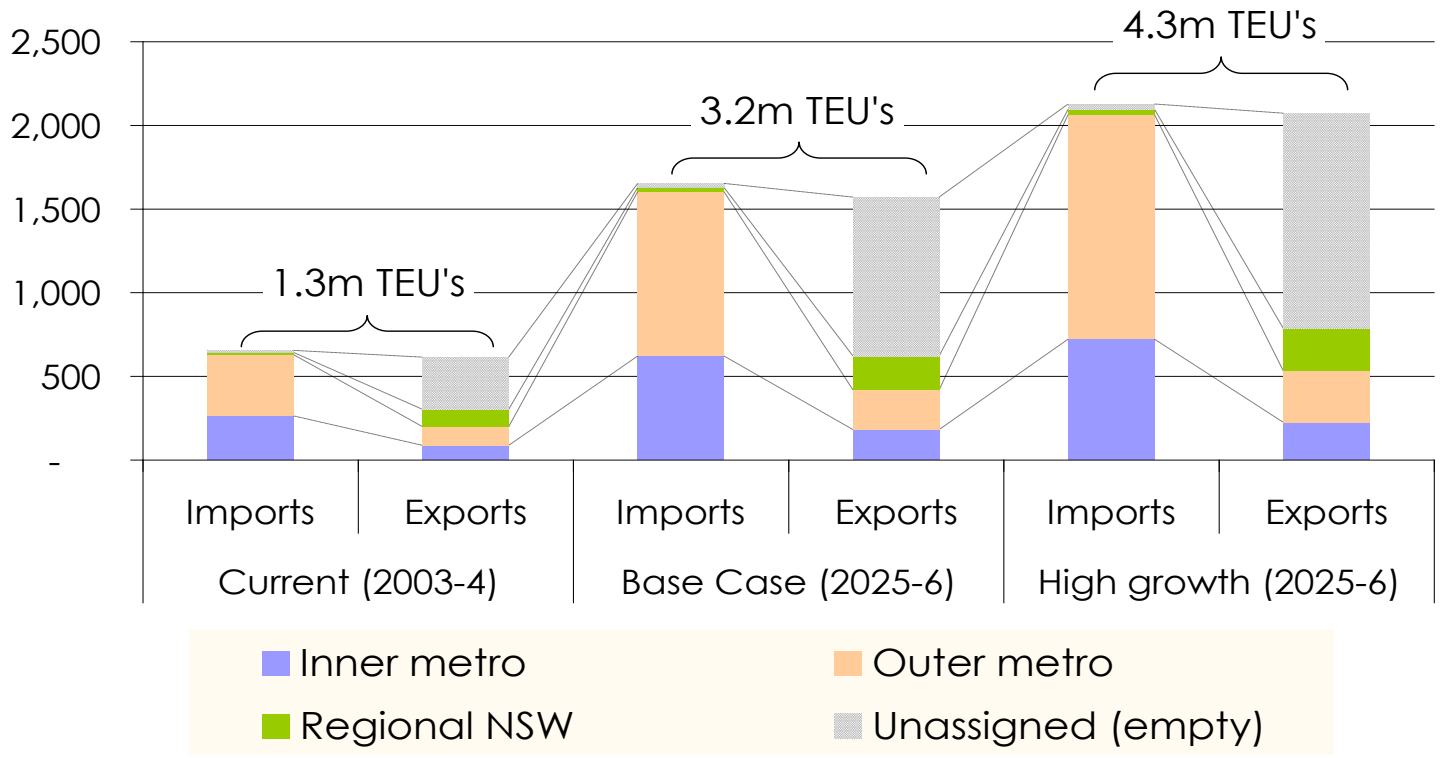
Composition of Freight Flows

		2004			2025 (Base Case)		
		Imports *Mteus*	Exports *Mteus*	Total *Mteus*	Imports *Mteus*	Exports *Mteus*	Total *Mteus*
Full containers	*Metro*	0.60	0.23	0.83	1.48	0.45	1.93
	Rural	0.03	0.12	0.15	0.07	0.25	0.32
	Total	0.63	0.35	0.98	1.55	0.70	2.25
Empty containers	*All*	0.02	0.30	0.32	0.05	0.90	0.95
Totals	*All*	0.65	0.65	1.30	1.60	1.60	3.20
% Full		97%	54%	75%	97%	44%	70%
% Empty		3%	46%	25%	3%	56%	30%

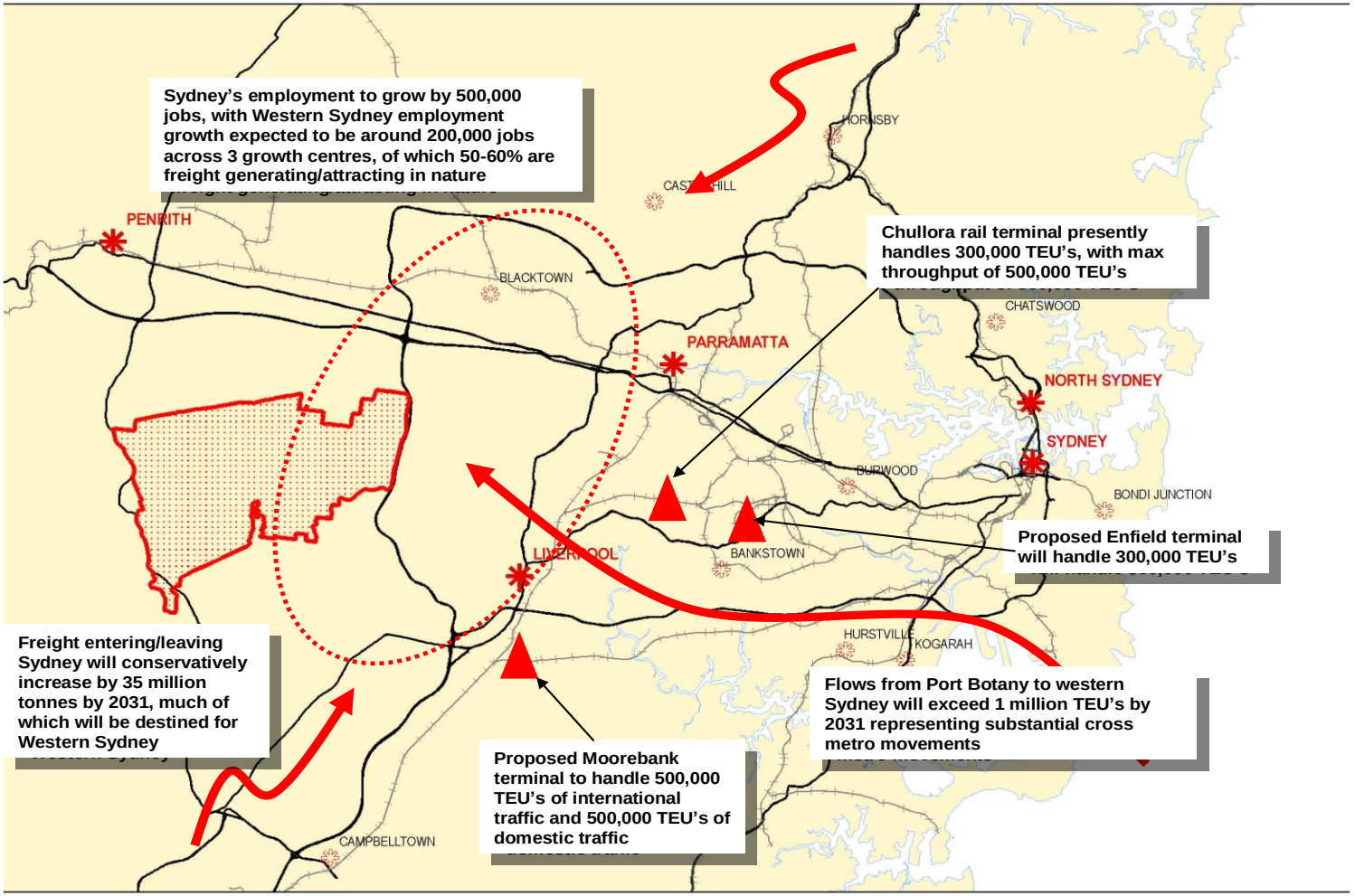
Flow imbalances act as a major impediment to an efficient rail/road service capability, limiting rail to no more than 40-50% market share

Implications of future demand

- Import volumes will focus on Sydney metro region, with a significant increase occurring in the Outer Western areas
- The export of empty containers will continue to dominate export logistics processes



Sydney's key challenge is the burgeoning freight precinct ion the western suburbs



Systems and elements

- Port interfaces
- Rail economies
- Terminal capacity
- Empty containers
- Comparative costs

Urban intermodal systems

- Seen as 3 key elements
  - *Port/land interface*
  - *Road and rail networks*
  - *Inland terminals and freight clusters*

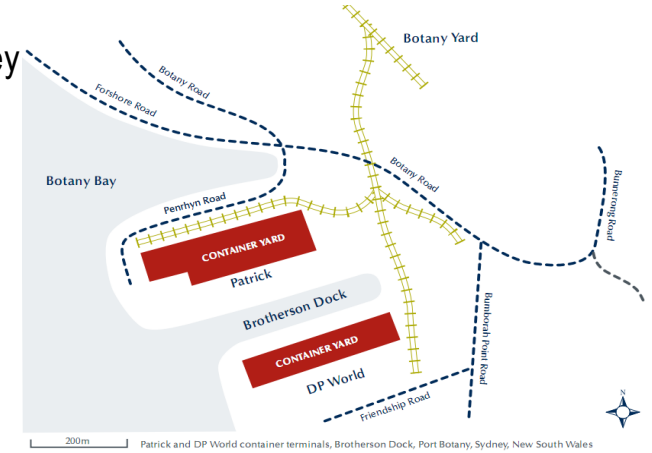
- Critical future metrics for Sydney (2025)
  - *Road movements, cross metropolitan range 3,500 to 4,500 trucks per day; 500-600 trucks in the morning peak*
  - *Rail movements 55-60 trains per day*
  - *Terminal and container storage "footprint" totals 150 hectares*

The port interface … issues and dynamics

- Conflicting agendas amongst some key stakeholders
  - *Vertical integration*
  - *Cost shifting*
- Past unfettered open access for rail enhanced tactical competition however (arguably) reduced port-rail effectiveness
- 'Historic' focus/sequence was ship → road → rail
  - *Rail "third" amongst equals.*
- Port "real estate" is at a premium in terms of cost and supply.
- Opportunity for enhanced land transport linkages facilitates increased port capacity for existing infrastructure.
- Rail infrastructure alone does not facilitate efficient train operations

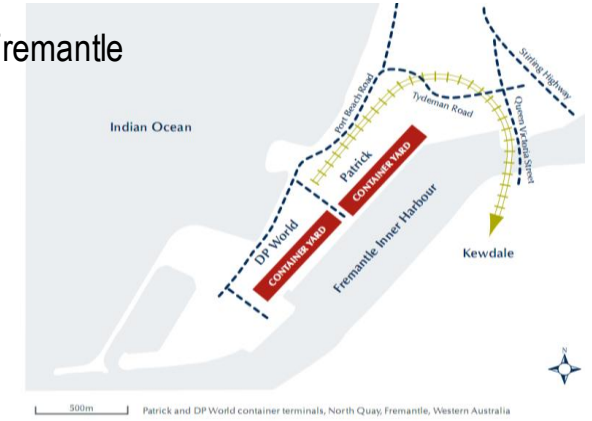
Port precinct layouts

Sydney



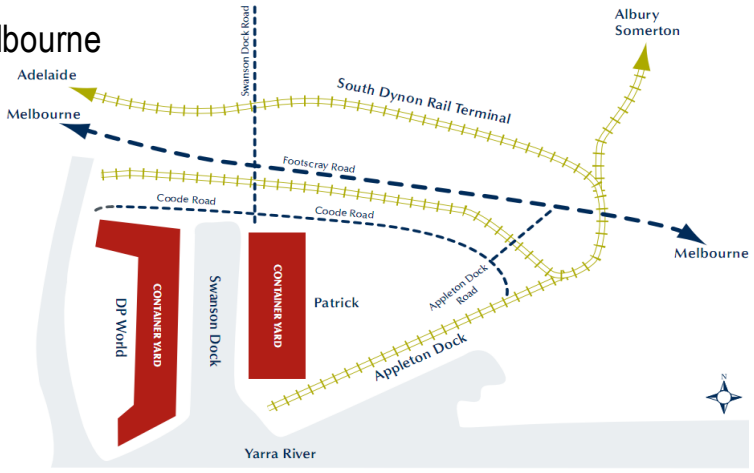
Patrick and DP World container terminals, Brotherson Dock, Port Botany, Sydney, New South Wales

Fremantle



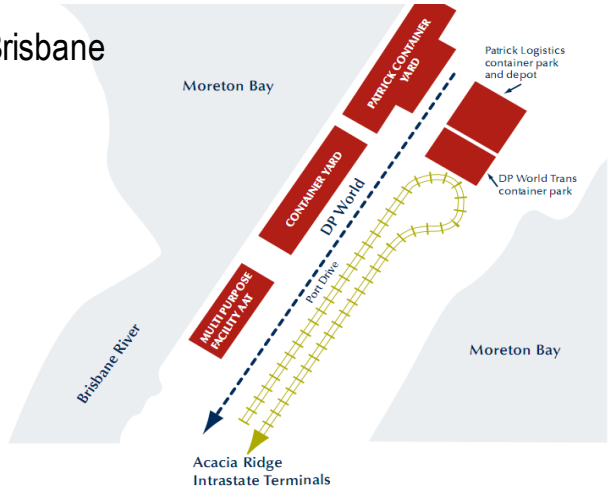
Patrick and DP World container terminals, North Quay, Fremantle, Western Australia

Melbourne



Patrick and DP World container terminals, Swanson Dock, Port Melbourne, Victoria

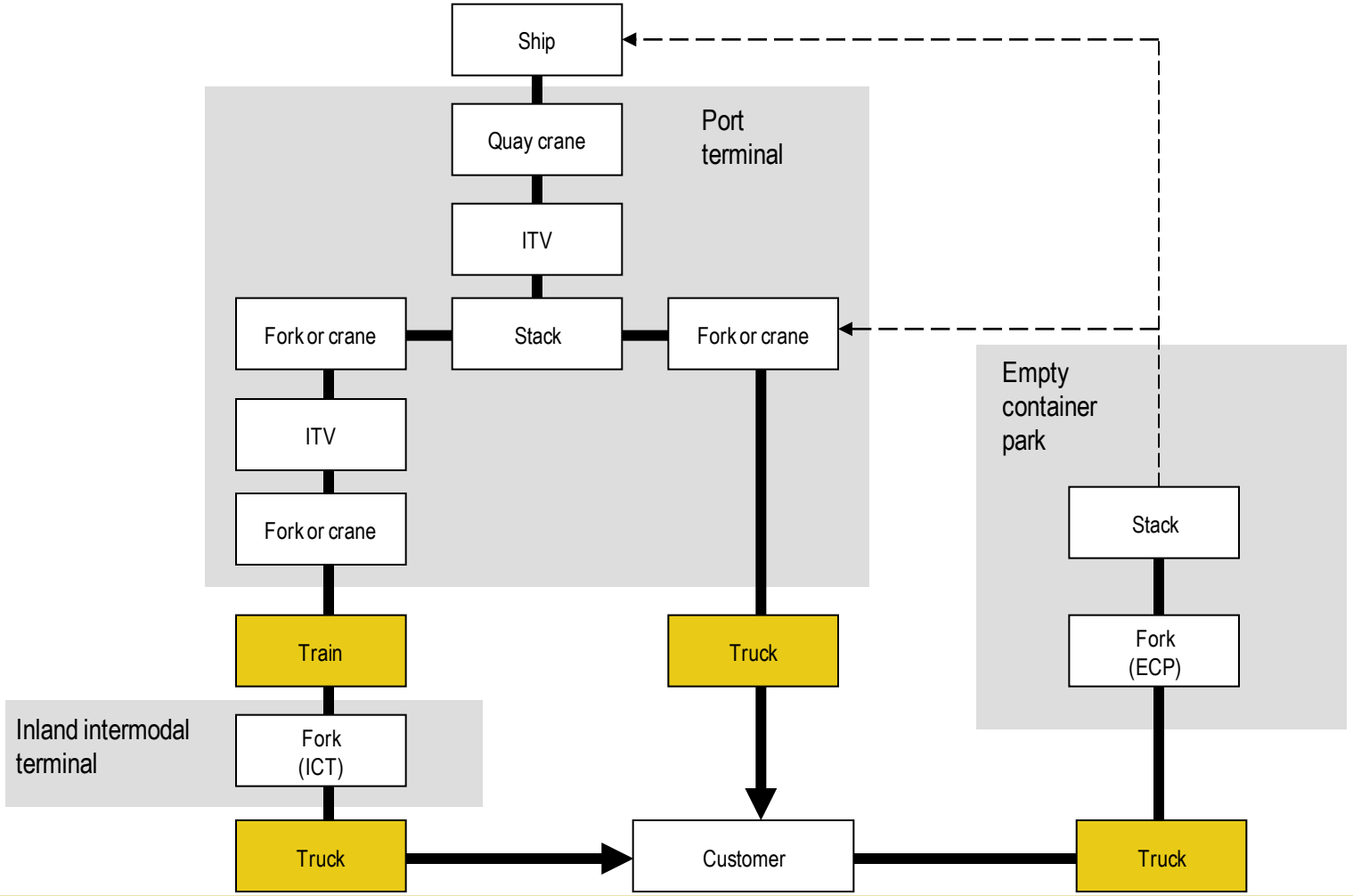
Brisbane



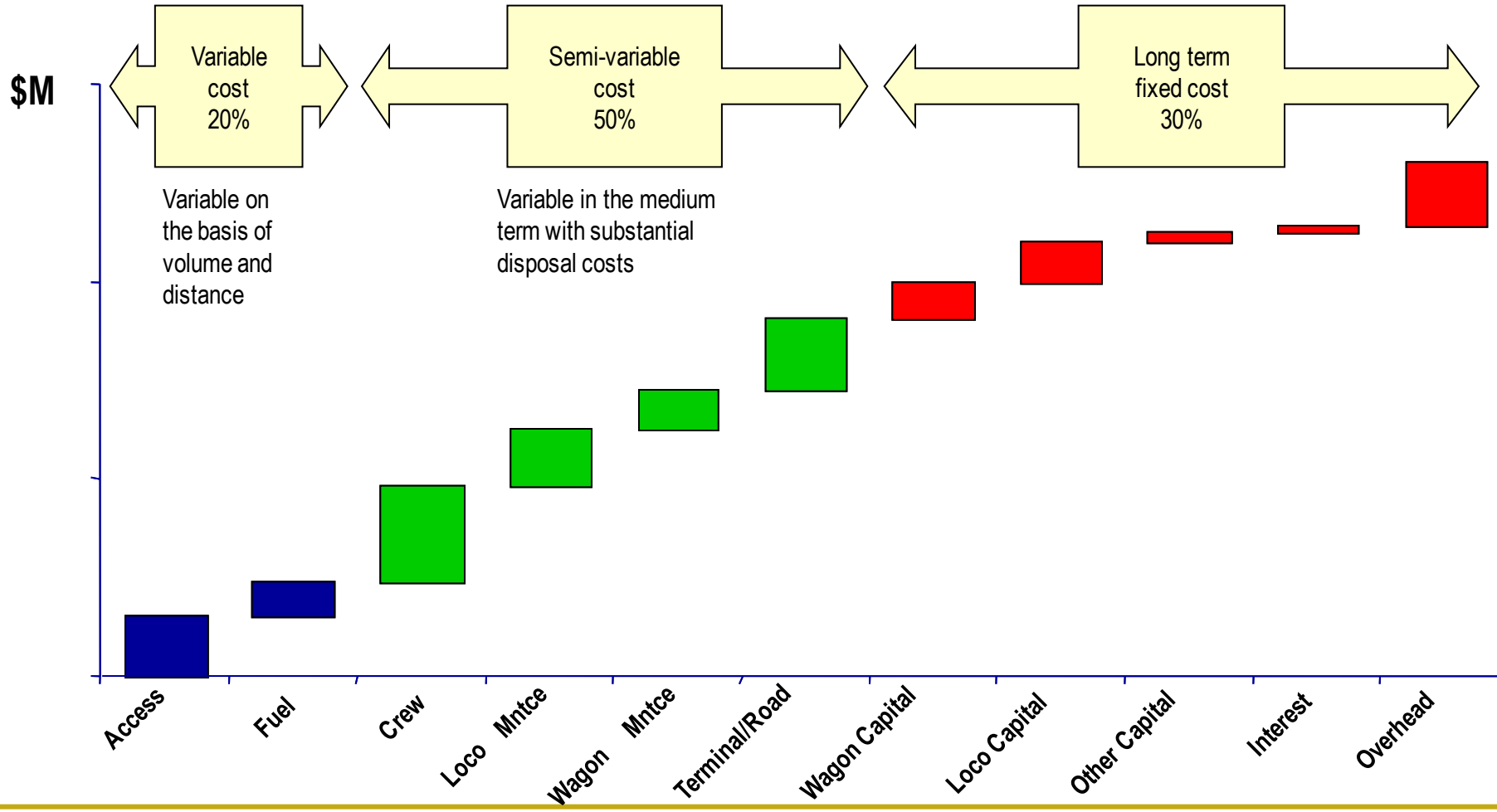
AAT, Patrick and DP World container terminals, Fisherman Islands, Port of Brisbane, Queensland

Source Waterline 44, 2008

Structure of flows – import movement
The stevedore has more work to do to service rail interface

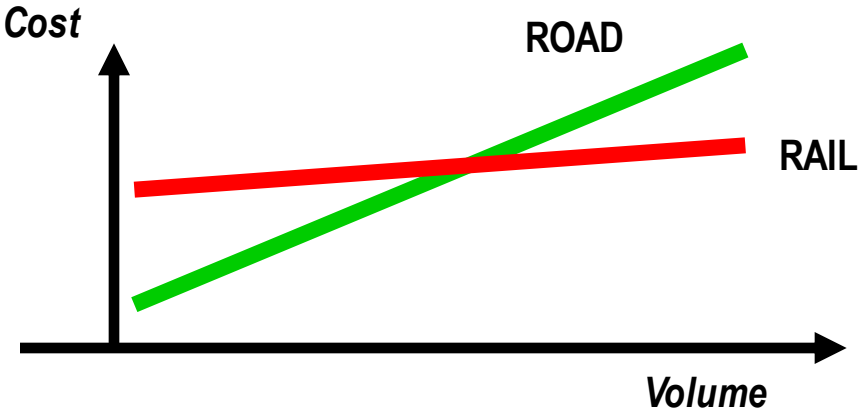


Rail economics
Fixed, semi-variable and variable cost



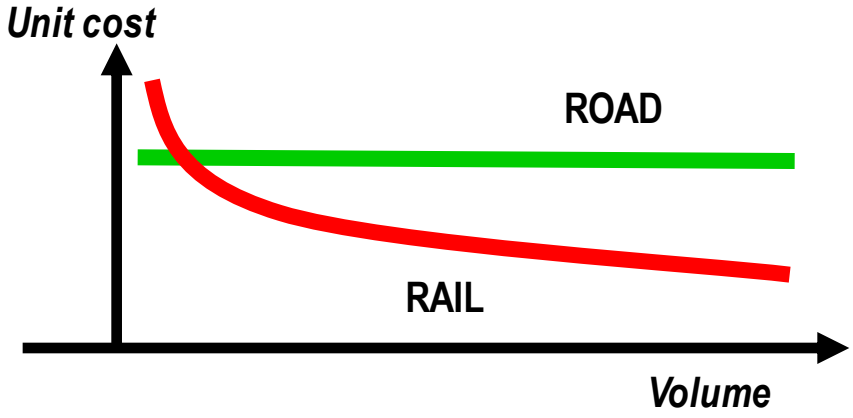
Increasing volume for rail will provide significant cost advantages within a single network

Road cost profiles have greater direct relationship between volume and cost



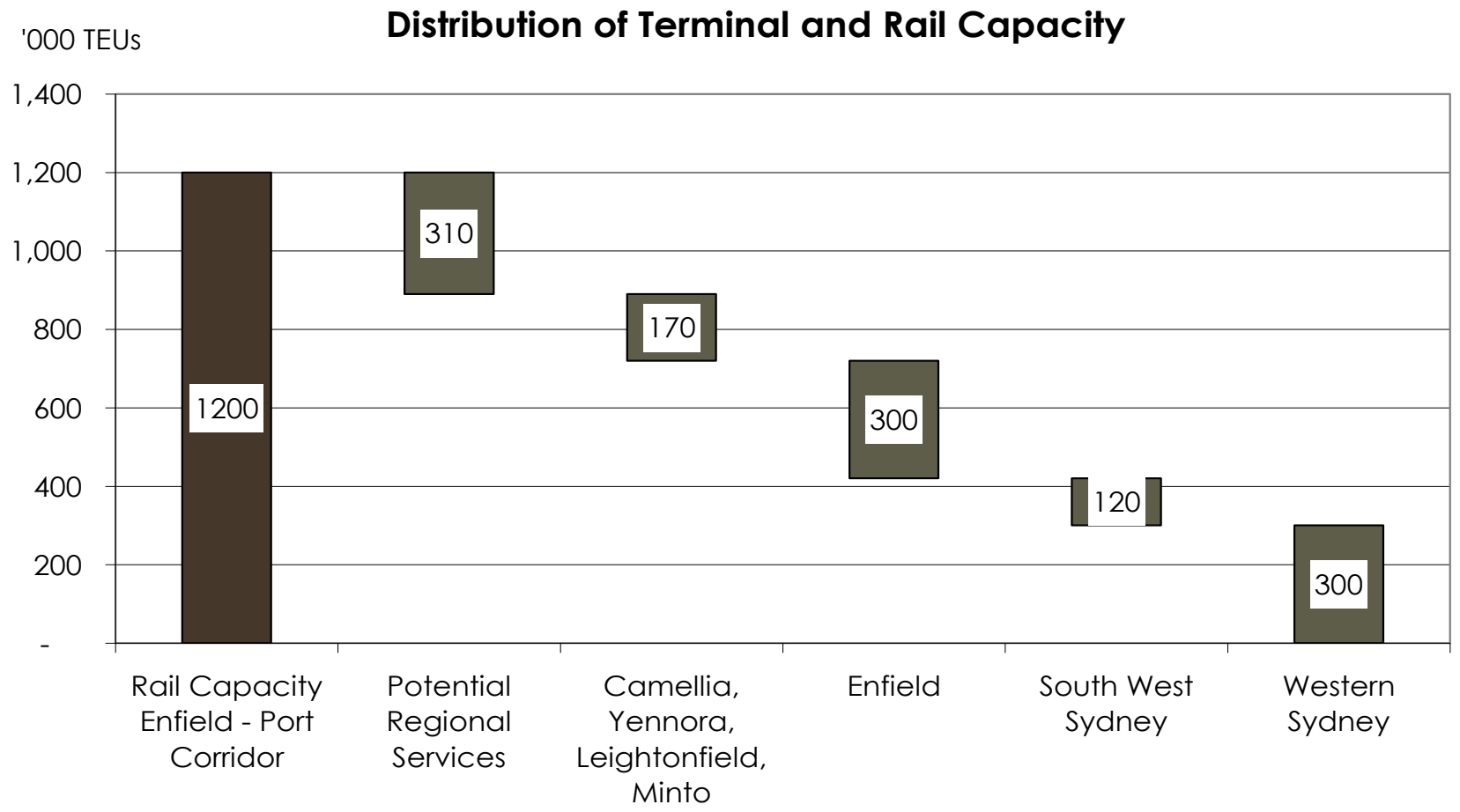
Rail operations have high fixed costs and low marginal costs

Road units costs do not vary significantly with volume

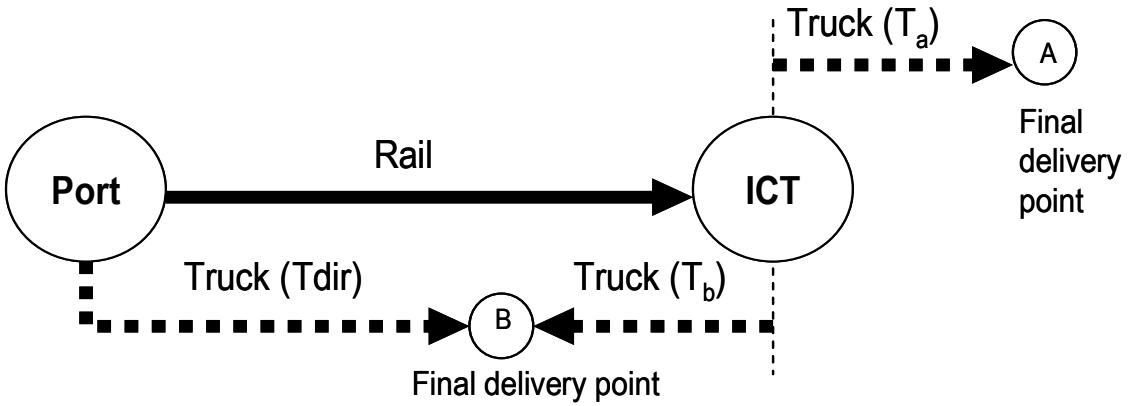


Rail provides for a lower unit cost with increasing volume

Given a finite capacity on Botany to Enfield rail corridor is 1.2-1.4 m TEU's, what is the best distribution of terminal demand across rail line capacity in 2025?



There is a need to understand spatial relationships amongst chain elements and the relative distances of road and rail journeys



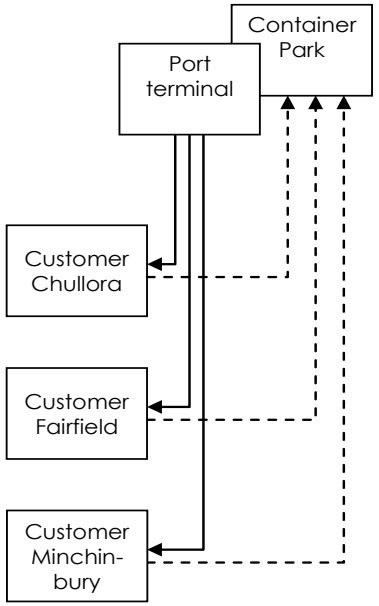
	Associated Road Journey (distance)		
Rail Journey (distance)	**Short (0-10 kms)**	**Medium (10-50 kms)**	**Long (>50 kms)**
Short (25-50 kms)	Ideal where consignee (A) is located further away from the port precinct, that is T_a relative to the rail movement. For (B) T_{dir} may eventuate where service demands require speed to market	Rail not competitive and economics dictates that road may best placed to complete the entire journey. For example, Enfield.	Rail is not competitive with road
Medium (50-150 kms)	Ideal, however in some regions the prevailing road market rates work against rail, eg back-loading – typical for Newcastle and Port Kembla	Ideal where consignee is located further away from the port as per Ta, otherwise Tdir will occur if Tb excessive relative to rail	Also depend on the prevailing road prices, train service frequency and product type
Long (>150 kms)	Ideal,for (A) & (B), and less affected by back-loading influences	Ideal where consignee is located further away from the port, as above	Ideal where consignee is located further away from the port, however freight densities may provide efficient under Tb scenarios

Within a rail industry context, the literal interpretation of a "long rail journey" would be considered Sydney to Perth, and a short journey would be Sydney to Brisbane, however the parameters used here are relative to a typical road journey for intrastate freight movements

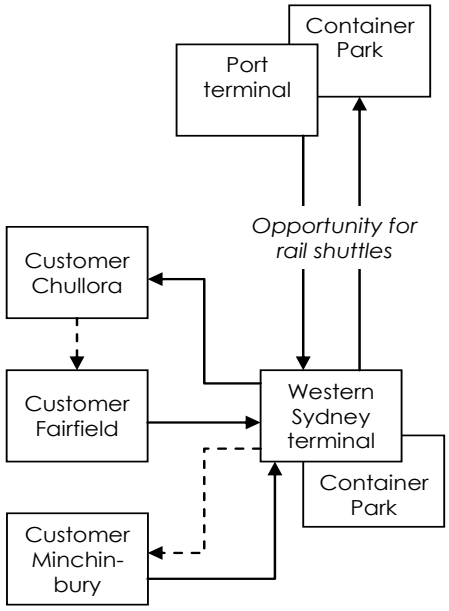
There is need to think differently about managing empty containers

- *Does land at Port Botany have higher strategic importance and value than storing empty containers?*
- *How can empty container transport in Sydney be made more efficient?*

Road dominated system with empty containers sourced and returned from Port Botany

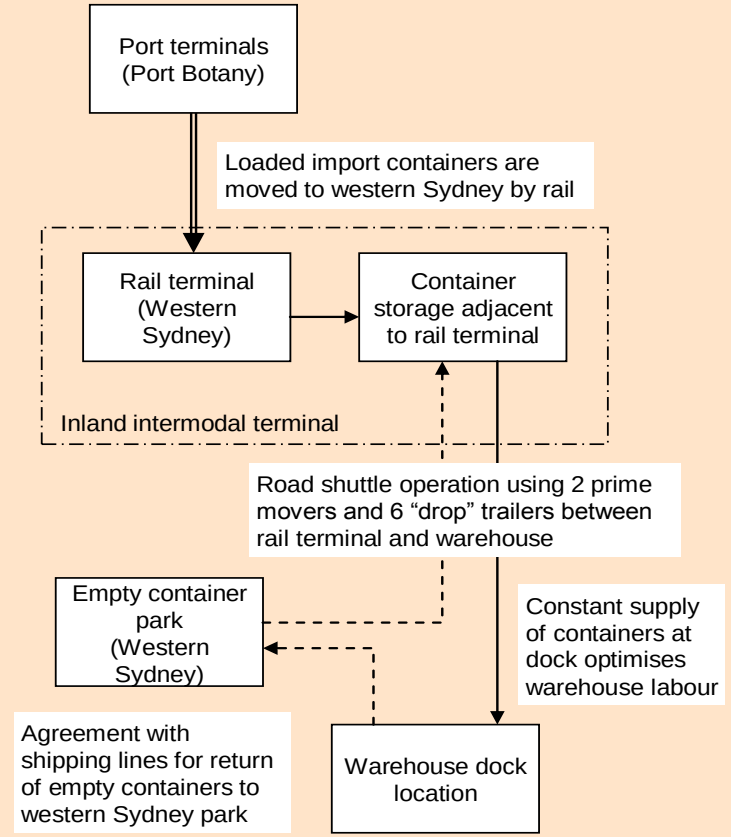


Road/rail system which holds empty containers nearer to market and returns any surpluses by rail to port



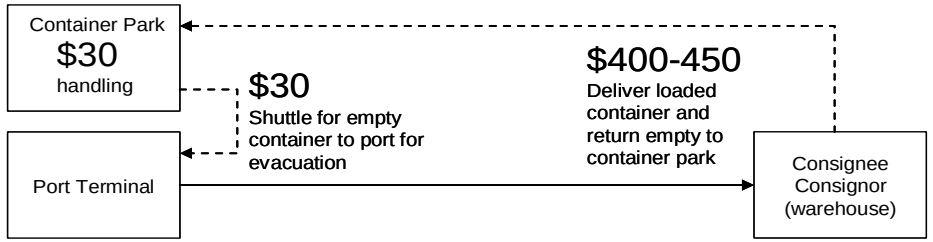
FMCG supply chain in western Sydney

Intermodal logistics model for the movement of import container to consumer goods company in Western Sydney



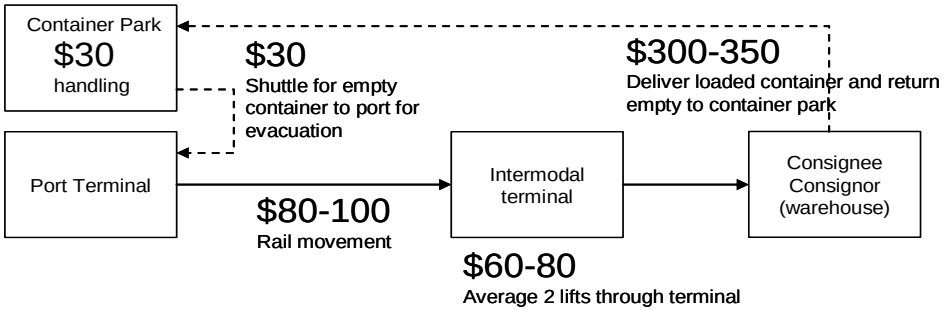
- Empty container park is integrated into IMT operation
- Excessive MT containers are evacuated back to the port by rail
- Road shuttles and warehousing operations complimented by IMT

Activity costs in port-land container cartage



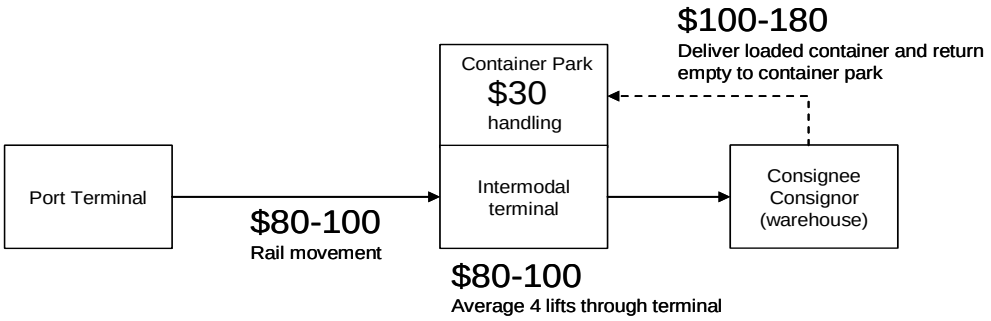
Typical road movement to/from port with MT container returned to port precinct

Cost - $460-510 per TEU



Intermodal movement with MT container returned to port

Cost - $500–590 per TEU



Intermodal movement with integrated container park

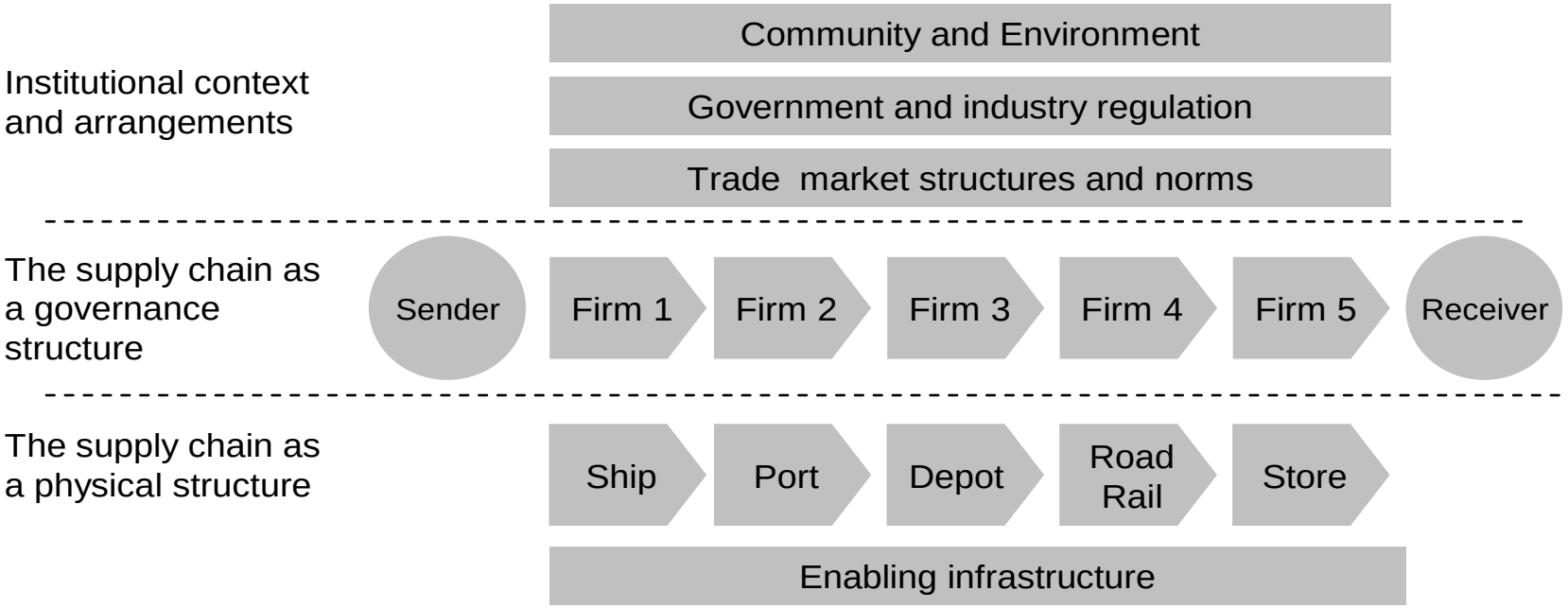
Cost - $290-410 per TEU

- Value chains
- Business Models
- Power and control

Is infrastructure the only impediment?

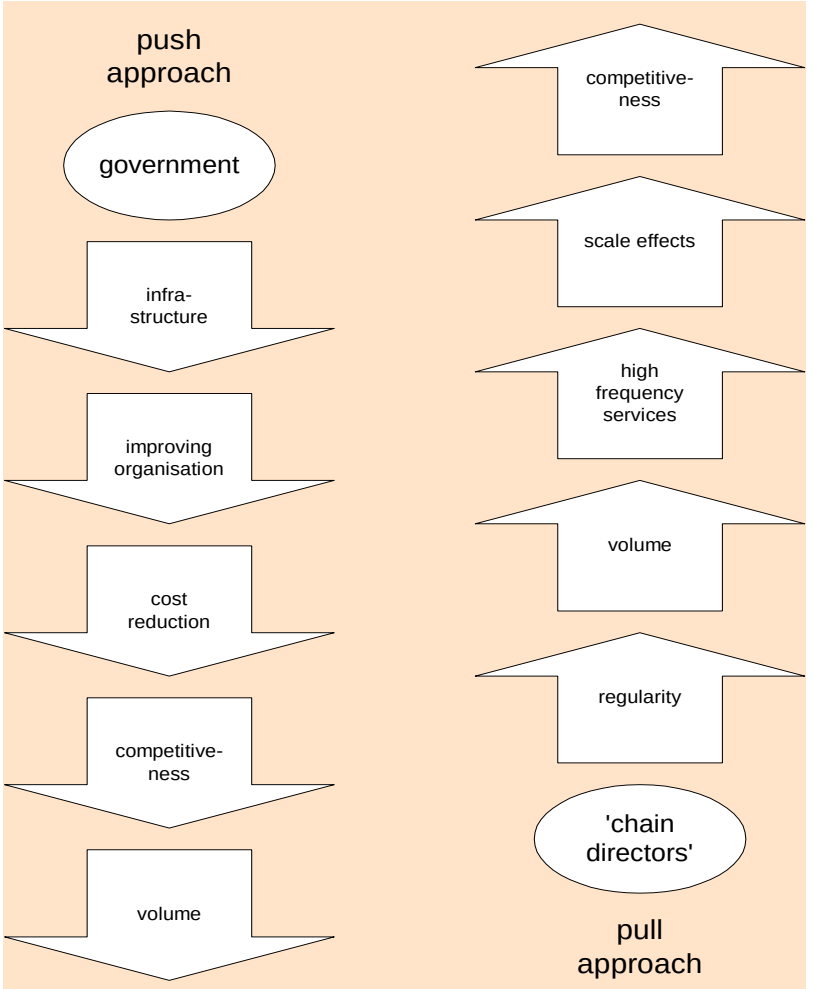
- Business models of the past are not suitable for future intermodal systems
- Key questions
  - *Who invests in and controls the chain?*
  - *What are the terminal and port access arrangements?*
  - *Who provides leadership and what is the role of government?*
  - *What is industry's capacity and willingness for change*
- Implications of "do nothing"

Infrastructure is only one element



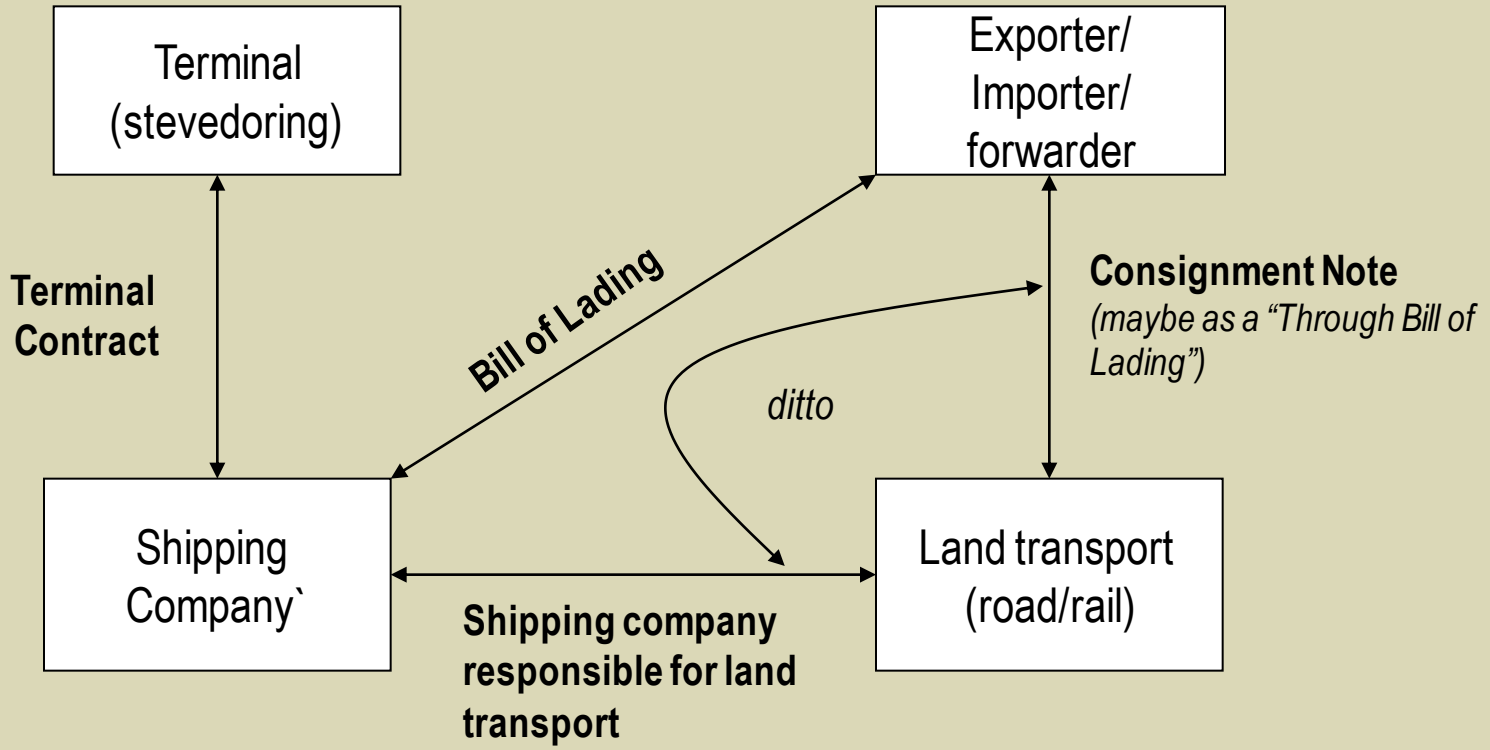
There are differing motivations which drive the development of intermodal chains, and who/when the players invest

- Is government interested in investing when industry is adopting a wait and see approach
- Industry will only invest when there is a proven concept and is competitive



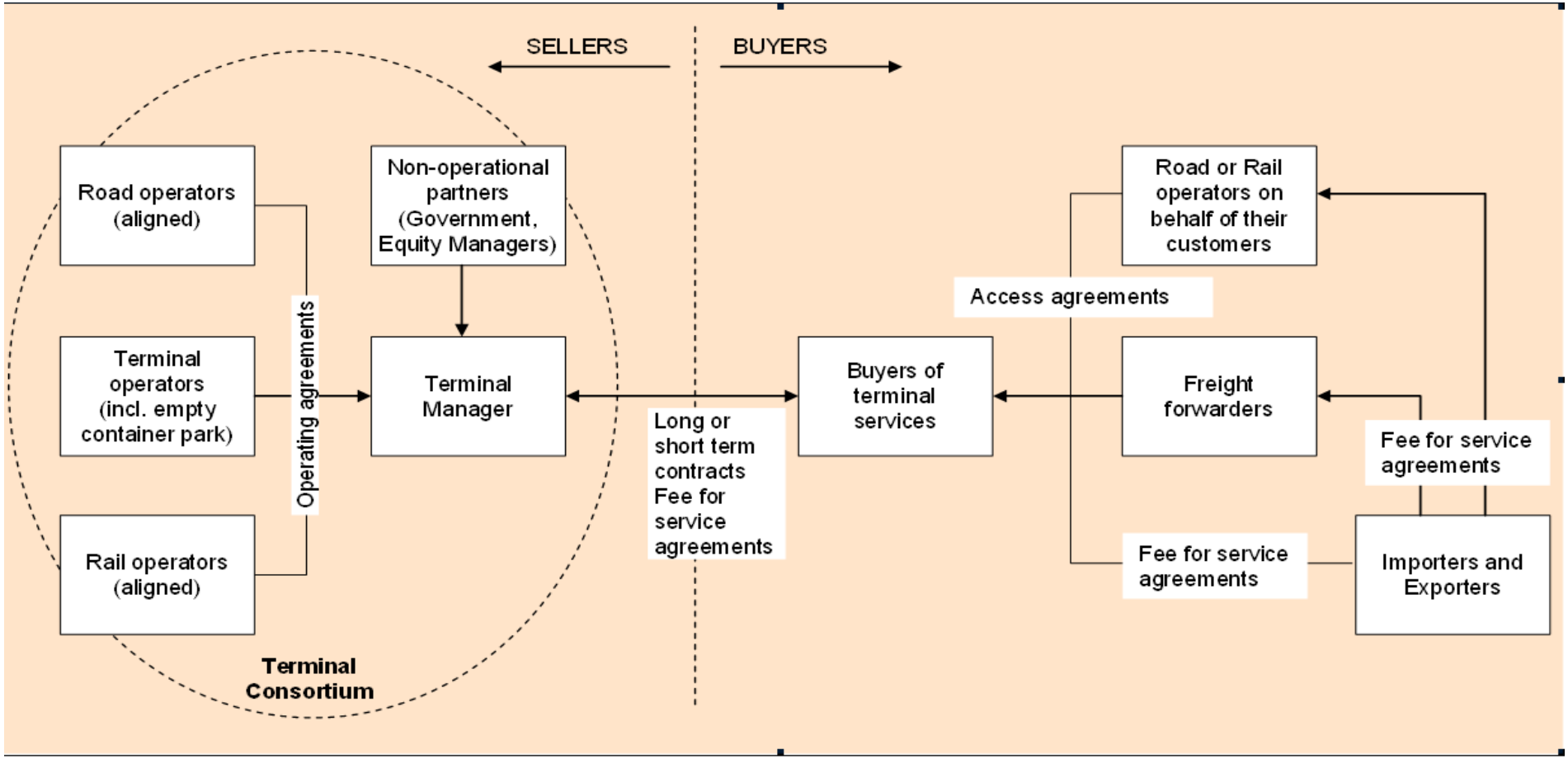
Henstra, D., & Woxenius, J. 1999. Intermodal Transport in Europe. Chalmers University of Technology;

Relationships have been commercially focused rather than “chain focused”

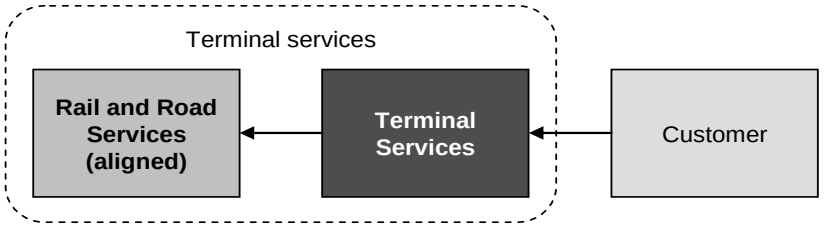
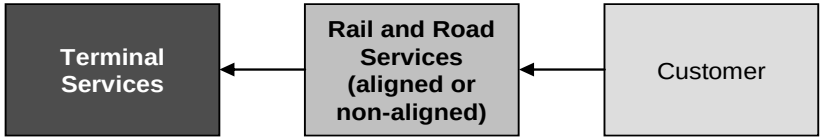


Commercial mechanisms required to define risk and responsibility have the effectively segment the chain, when viewed from a logistical perspective

Generic buyer – supplier relationships



Variations in commercial and service delivery arrangements

Type	Structure	Description	Key considerations
A **One-stop shop and bundled services**		The customer contracts directly with the terminal manager for the provision of terminal and intermodal transport services, and is charged a bundled all inclusive price against an agreed service contract	This model is the “one-stop-shop” option for customers; it is likely to operate for on-site tenants of a “freight village”, or where seamless flows are important service outcomes
B **Subcontractor services**		The customer contracts with a transport company, which in turn contracts with the terminal manager for access; the transport company maybe aligned within the consortium or non-aligned merely seeking access	The customer is likely to have an historic relationship with the transport company which suggests using the terminal as an alternate pathway. Customer may or may not be onsite in the “freight village”
C **Unbundled services**		Customer contracts separately with transport and terminal providers	Customer seeks to have transparency in pricing of individual activities and to be in “control” of supply chain activities; is likely to have substantial demand (and power) over other service providers

More reading …

- Papers at www.strategicdesign.com.au
- Regional Intermodal Terminals
- Sydney's Intermodal Systems (Parts 1 & 2)
- NSW Landside Infrastructure Capability: International Containers