

Urban Freight Transport: The Short Sea Shipping alternative for Melbourne

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Abstract:

Urban freight transport is becoming increasingly important to transport planners and policy makers as increasing congestion occurs on roads. The final report of the Victorian Competition and Efficiency Commission identifies the problem of congestion and the Victorian Transport Plan provides some answers to the problem. The development of Hastings is an initiative in the VTP which has merit in potentially alleviating port congestion. However issues of access and interconnection within existing freight nodes may result in road/rail congestion once Hastings is developed as a supplementary port to Melbourne.

Short sea shipping (SSS) occurs globally in locations where transport by barge or feeder ship is possible around a bay, coastline or river system, typically with transit times of a few hours to a day or two. There is extensive analysis of the literature of this shipping alternative in North America and Europe. The analysis covers the factors behind why SSS is chosen together with a discussion on cost factors and externalities associated with freight transport.

The need to fund transport infrastructure in a sustainable way to provide benefits for future generations calls for radically different investment strategies now. Water transport such as feeder containerships and container barges may provide an alternative to rail and road transport solutions which are likely to be extremely costly. An analysis of the potential to capture value in the supply chain is also presented. This analysis supports the paper's advocacy of SSS between the sea ports of Melbourne, Geelong and Westernport (Hastings) in Victoria.

Authors' Biographies:

Shanta Hallock has worked in the maritime sector offshore as a senior manager in freight operations and subsequently as a Transport Economist. As an economist he worked in the area of competition policy, export promotion and negotiations with shipping conferences on pricing from 1974 to 1988. Thereafter he worked in Telstra in the Major Project business on strategic pricing, complex bid evaluation and project evaluation. He now works for the Department of Transport in Victoria in the area of Investment evaluation and is an accredited Gateway reviewer. He has an M Sc in transport economics from the University of Wales.

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1 Introduction

This paper proposes Short Sea Shipping (SSS) as an alternative to road and rail transport in Victoria in the future (next 20 years). As the Port of Melbourne reaches capacity, Hastings has been proposed as a secondary or supplementary port. Should this materialise, the issue arises of how to connect the ports to facilitate inevitable East-West freight movement. This paper suggests an innovative solution using short sea shipping.

SSS is better known to the layman as coastal shipping. There is no universally accepted definition of the concept as discussed below in Section 2.1. SSS is however to be contrasted with deep sea shipping which has transit times of many days or more often weeks as opposed to a typical transit in SSS being more commonly measured in hours or two or three days at the most.

SSS is important because it is capable of providing a sustainable alternative to road in the movement of cargo. As a concept it is gaining acceptance in Europe as well as in the US. Examples of these solutions are provided in sections 2.2 and 2.3 below. The European initiative “the Motorways of the Sea”, which has EEC backing, is particularly commended.

In order that this paper has relevance to policy makers and practitioners sections 2.3 and 2.6 consider intensely practical issues. Section 2.3 examines the factors behind the choice of SSS and section 2.6 moves the discussion into the realm of how SSS may facilitate value capture in the supply chain. Additionally section 2.5 on urban congestion would also interest policy makers since it sets out the projections for congestion on Melbourne’s roads that SSS could ameliorate.

Policy makers, supply chain managers and terminal operators should find the ideas presented here challenging and consider the option of SSS between Melbourne, Geelong and Hastings in the future.

2 Literature review

2.1 Definition of Short Sea Shipping (SSS)

Marlow Petit and Scorza. (1997) initially attempted a simple and all encompassing definition of SSS e.g. “*seaborne flows of all kinds of freight irrespective of the vessel flag*”. Later, Paixão and Marlow, (2005) made the definition more comprehensive by including criteria such as ship type, markets, logistics requirements, service offerings,

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geography and classification of SSS according to size. In contrast, Stopford (1997) uses a simple criterion and regards it as maritime transport within a region serving port to port feeder traffic in competition with land transport.

Crilley and Dean (1993) view SSS in terms of ship characteristics in contrast to Van de Voorde and Viegas (1995) who suggest a preference for a definition in terms of trading patterns. Perakis and Denisis (2008) also suggest that there is no strict taxonomy of SSS. They cite examples of shipping lines serving the US trade route which includes the Caribbean and Mexico that use a mixture of vessel types. These vessel types include container barges, Roll-on Roll-off and Load-on Load-off; however break-bulk shipping is not cited.

Other authors use a jurisdictional definition. This includes the terms “cabotage” and “coastal shipping” i.e. based on state borders which is also used by some to define SSS e.g. the European Conference of Ministers of Transport (ECMT, 2001). These terms are widely used to refer to trade reserved for national flag vessels although in some instances third flag carriers may be allowed to participate in these trades. Coastal shipping features prominently in the literature of the Economic and Social Commission for Asia and the Pacific organization that has conducted many surveys and generally promoted the concept. In Australia the Navigation Act (Australia 1912, sec 7) defines a coastal trade as “*A ship shall be deemed to be engaged in the coasting trade, within the meaning of this Act, if it takes on board passengers or cargo at any port in a State, or a Territory, to be carried to, and landed or delivered at, any other port in the same State or Territory or in any other State or other such Territory:*” This too is a definition based on jurisdiction . In Australia the term has been mainly used to refer to inter-state trade (e.g. Melbourne / Adelaide).

2.2 How widely is SSS encountered in national commerce?

Short Sea Shipping is used effectively in Europe, North America and parts of Asia. SSS in the form of barges, is in use in Asia, North America and Europe. For example, JVC Belgium has its Euro distribution centre set up in Boom halfway between Antwerp and Brussels on the Antwerp-Brussels Charleroi canal. Arrangements with shipping lines results in all European containers being discharged at Rotterdam and on-carried to Boom on three services a day and then to Antwerp (Rodrigue and Notteboom, 2009). CONTARGO in the North Continental Port range offer barges on both short routes 50 km and longer routes with a matched value proposition to cargo needs. Three scenarios are offered: barge combination, truck only and rail combination, with CO₂ emissions offsets provided for each scenario (CI, 2008a).

There are more examples; *Trans European Transport Networks* and *Marco Polo*. The European Commission’s *Motorways of the Sea* concept stems from these programs. *Marco Polo* is the European Union's funding programme for projects which shift freight transport from the road to sea, rail and inland waterways. This means fewer trucks on the road and thus less congestion, less pollution, and more reliable and efficient transport of goods. For instance, “*a motorway of the sea route could be developed along the Atlantic coast to provide a sea-lane running parallel to motorways*” (ECT 2005).

The concept is designed to bring about a structural change in transport organisation in the years to come. These chains will be more sustainable, and should be commercially more efficient, than road-only transport. The concept requires integration of maritime transport resources, rail and inland waterway, as part of an integrated transport chain. According to the European Commission, the added-value of the “motorways of the sea” will:

- provide more efficient, cost effective, less polluting freight transport
- reduce road congestion on key bottlenecks across Europe
- provide better, more reliable connections for peripheral regions
- play a role in making Europe’s economy stronger and more sustainable.

In Asia, SSS is being utilised to a growing extent. The Shanghai International Port Group (SIPG) owns 700 trucks but also moves 2 million TEU each year via its subsidiary, JI HAI Barge Company (CI, 2009). The Shenzhen port complex uses shuttle barges (CI, 2008b) as does SIPG at Yangshan to Hong Kong.

In North America the Great Lakes feeder lines offer 221 TEU ships servicing Halifax and Montreal (CI, 2008c). Perakis and Denisis (2008) list SSS operations in the US in 2006/2007, encompassing both coasts and all types of ships.

2.3 What factors are considered in the choice of SSS?

Price, transit time, image and state intervention policy / funding have been identified as key factors in the selection of SSS.

Garcia-Menéndez *et al.* (2009) investigated a road versus short sea discrete mode choice in Europe, drawing conclusions from personal interviews with freight buyers in four industry sectors and identified the modal splits for these sectors.

They found that shippers’ decisions to pick SSS were more influenced by changes in road transport prices than changes in sea transport costs. Modal switching to SSS could be induced by imposing an “ecotax” on road transport. This is consistent with the European Commission (EC) finding that, the door-to-door price by sea would have to be 35 per cent less if door-to-door road traffic were to switch to SSS (EC 1996).

Sánchez (2005, p234) writes in the context of Central America, where poor road infrastructure prevails. He notes that despite political agendas emphasizing the benefits of waterborne transport (emissions, congestion etc) road transport continues to expand. Three necessary conditions to bridge land infrastructure deficits by waterborne transport are identified: building awareness and knowledge of SSS, competitive port and landside costs, public funding to complement private investment. These themes are reiterated by others.

Brooks and Trifts (2008) examined the choices of truck vs. Short Sea in the North American context. They found among other things that short sea was favourably perceived. They built on unpublished work done at Dalhousie University (where they were based) which analysed the feasibility of SSS on the east coast of Canada and the US. This study was able to identify some of the challenges facing a modally

integrated SSS attempting to compete effectively with all-truck routes. The research concluded there were four factors:

1. Demand
2. Meeting shipper requirements
3. Meeting potential operator needs, and
4. Some policy changes on the part of government

They focused on the second of these elements—meeting shipper requirements and found that a slower but less expensive mode has an overlapping distance range in which it competes with a faster but more expensive option. Outside the range there is a clear modal preference, lending further support for previous research (Resor and Blaze, 2004; Jiang, Johnson and Calzada, 1999). Figure 1 shows how shippers purchase freight transportation services and the choices made between service options particularly when a new transport mode option, SSS, which does not exist on the routes, is introduced. It is for this reason that their work has been selected as possible relevance to Victoria. The routing of cargo using a Hastings/Melbourne/Geelong supply chain/port configuration may favour a range of cargoes depending on the time sensitive nature of these cargoes.

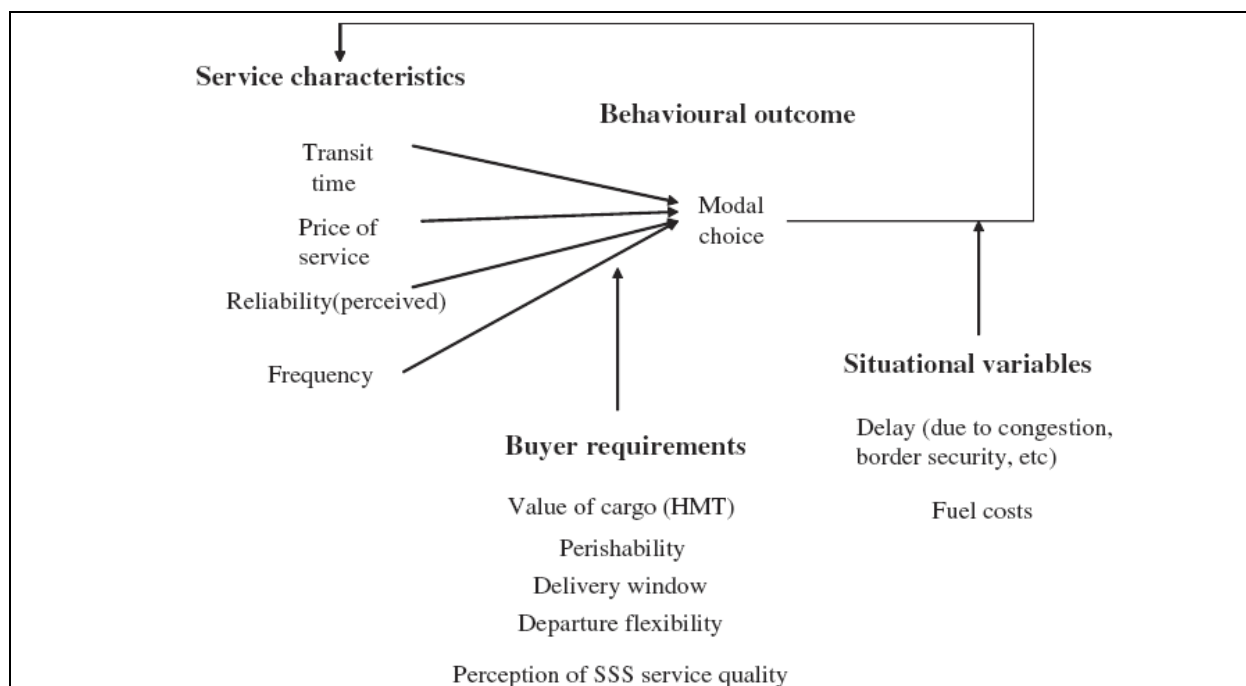


Figure 1 – Mode choice model

Source (Brooks and Trift, 2008)

2.4 Cost Factors and Externalities

Musso and Marchese (2002) provide a different conceptual framework within which economic/transport and geographic variables can be combined to determine the potential competitiveness of SSS. The approach relies on the differentials in terminal and haulage costs to work out an “economic distance” for each competing transport mode. Detailed feasibility templates which would supplement Musso and Marchese are presented by Chang (1988) who used for his analysis barge companies on the

Mississippi. He makes comparisons with all classes of vessels, for instance towboats, open-hopper barges and also includes breakeven costs of operation.

The pollution mitigation potential of SSS is recognised by numerous authorities – Perakis (2009) Marlow (1997) and the ECT via its Marco Polo Program (ECT 2005). The issue of land transport not internalising the major external costs it generates is recognised by Musso and Marchese as something that offers road an unfair advantage. BTRE (2007) notes the social costs of congestion \$6.1bn for Melbourne by 2020 refers to estimated aggregate costs of delay, trip variability, vehicle operating expenses and motor vehicle emissions—associated with traffic congestion—being above the economic optimum level for the relevant network. These costs are not “internalised” or paid for. SSS is comparatively less polluting than road or rail. Evidence from the EEC (Table 1) and Australia (Tables 2 and 3) follows. Greenhouse gas emissions in the EEC (2006) are given below and data on all emissions is also shown.

Table 1 – Greenhouse Gas emissions from transport in the European Union (27 states)

Source	CO ₂ -e emissions (million tonnes)
Road	902.0
Rail	7.8
Shipping	
Coastal	23.4
International	171.3
Total Shipping	194.6
Air	
Domestic	25.6
International	129.8
Total Air	155.4
Other Transport	10.1
Total Transport	1269.9
Total Emissions	4558.7

Source: EEC (2006)

Table 2 – CO₂-e emissions by transport mode, 2000 - 2020

Year	Emissions of CO ₂ -e by transport mode (gigagrams)						Total
	Car	Road Freight	Air	Rail	Coastal Shipping	Other	
2000	40,696	20,762	4,996	3,518	1,505	1,980	73,456
2020	50,110	31,874	11,922	4,848	1,359	2,292	102,406

Source: BTRE (2007)

Table 3 – Non CO₂ emission projections to 2020

Source	Emissions (gigagrams)				
	NO _x	CH ₄	NM VOC	CO	N ₂ O
Rail (non-electric)	2623.0	64.40	0.23	21.80	0.08
Coastal shipping	28.6	0.07	1.16	2.94	0.04

Source: BTRE (2007, pp. 213 and 231)

2.5 Urban congestion

Freight flows have a tendency to exacerbate existing congestion on roads caused by the motor car. In some cases where there has been no grade separation, a freight train can close a major road frequently for up to 20 minutes at a time e.g. Footscray Road in Melbourne was one such case, until the Dynon Port Rail Link Project separated road and rail. Congestion on rail networks happens when there is contention in the operation of passenger and freight having to use the same track. Technically this is caused by a limitation of train paths in the urban network which freight shares (e.g. in Sydney where there is a curfew on freight) and conflicting speeds. Freight trains are slower, often approaching 2 km in length and consequently “block” a train path.

BTRE (2007) estimates the cost of congestion in Australia to have been \$9.4 billion for 2005. This total comprised \$3.5 billion in private time costs, \$3.6 billion in business time costs, \$1.2 billion in extra vehicle operating costs, and \$1.1 billion in extra air pollution costs. The social costs of congestion rise, to an estimated \$20.4 billion by 2020. The city specific levels rise to approximately \$7.8 billion for Sydney and \$6.1 billion for Melbourne.

The BTRE’s prognosis on traffic forecasts for freight and passenger vehicles can be summarised as:

- Growth in car traffic in the cities tends to decelerate over time,
- Rapid growth in the light commercial vehicle (LCV) fraction of the traffic (which is already a substantial part of the traffic stream). Annual growth in total vehicle kilometres travelled by LCVs has averaged between 3 and 4 per cent for well over 20 years, and economic growth will see this trend continue to 2020.
- Heavy trucks also grow quickly but from the base of a small fraction of the current traffic stream.

The BTRE paper predicts that “Approximately as much traffic in absolute terms will be added to the average city network in the next 15 years as was added in the past 15 years.”

The Victorian Government’s views on congestion may be noted in the (Victorian Competition and Efficiency Commission’s (VCEC) report on congestion where the section applicable to freight makes provision for rail corridors linking Hastings to the main rail network (Victorian Government, 2007). The Victorian Transport Plan (DOT 2008), and both Freight Futures and Port Futures (DOT 2008 & 2009) addresses the issue of congestion over a 20 year timeframe as did Meeting our Transport Challenges (DOI 2006). The major solutions in these documents range from the proactive management of trucks in urban areas, to the use of high productivity vehicles and moving more freight by rail to solve inter and intra state cargo movement. However all the measures rely on land-based initiatives.

2.6 Value capture in logistics and SSS

A final concept which has relevance to the potential role for SSS is to consider the importance of “value capture”. By value capture we mean the exploitation of

strategies that will result in higher levels of productivity and efficiency. Value capture is inevitable if a port is to survive under the scenario of the future proposed by Robinson (2002). Robinson observed that ports had continued to view themselves as places where cargo interchange took place rather than strategic locations in a supply chain. Consequently they have realised too late that they are in fact embedded in a supply chain.

Robinson (2006, page 41) takes this further arguing that value migration occurs when customers perceive new options, resulting in outmoded business designs giving way to those that satisfy customer need better. In discussing strategies in Australia to move “more to rail” to ameliorate congestion, he argues that such strategies are merely “coping rather than long term development”. Robinson argues that value has migrated from the terminal operation and trucking operations to an integrated operation involving third party or fourth party logistics providers. Whilst the evidence for this may be clearer in Europe and North America his thesis has relevance to a possible future for Hastings. This concept allows integration of the activities of the terminal operators, the port and landside partners in the supply chain itself leading to value capture if opportunities are spotted and exploited.

Magala (2008) discusses the situation facing a regional port in the shadow of a metropolitan port (not unlike Hastings and Melbourne) and in particular how it could become competitive by using the following tactical factors in capturing value.

- Market access
- Perceived benefits (economic & non economic)
- Resource availability
- Business and political risk

Rodrigue and Notteboom (2009) suggest developments in logistics and supply chain management around terminalisation may be of relevance. The use of dwell times and a strategically widened role for terminal operators may be a way this value can be captured. They introduce the concept of modal separation of space and time, i.e. an opportunity for trading off time utility vs. space utility, as a means of unlocking value. The concept of “terminalisation” of supply chains is developed, where terminals might be bottleneck-derived or warehouse and buffer driven. Operational issues (space, port calling frequency) create demands impacting on performance and reliability-creating bottle necks which have to be overcome. Warehousing derived terminalisation is where there is an expectation that the warehouse becomes the buffer rather than the distribution centre (DC). This may be partly driven by cost or trade terms but the authors argue that this is a result of pull logistics and the evolution of flexible supply chains. In essence it is an inventory in transit strategy which uses “inventory at terminal” to reduce warehousing cost. It can succeed where DC / warehousing is costly and where shipping lines are chasing cargo.

The foregoing provides an opportunity to test Robinson’s (2002) view that ports/players are elements in a value chain that need to adapt; changing their *modus operandi to survive*.

It is plausible that in the future value can be unlocked in a supply chain using SSS for cargo transit from Hastings to Melbourne/Geelong and vice versa. Use of the SSS transport mode that may offer both a time differential and cost differential to road and

rail as well as greater temporary storage depending on how the supply chain/transport partnership interface is set up. SSS based arrangements may therefore be more attractive to some supply chains and cargo types. US consignees of some primary commodities and semi-processed agricultural produce preferred the slower transit time because it enabled them to use the vessel as a floating warehouse which phenomenon was recorded in Hallock (1983).

3 SSS in Melbourne and future issues

Travel time from Westernport (Hastings) to Melbourne by SSS is between 5.5 and 7 hours for speeds of 18 knots and 13 knots respectively) by SSS. This compares to about 3-4 hrs by rail and less by road. Travel times to Geelong will be slightly longer by water –approx 40 minutes but significantly longer about 1.5 to 2 hours by road or rail. Dedicated water transport, for instance feeder containerships and container barges, may provide an alternative to land based rail and intensive road transport solutions. Such ships could ply on a Hastings - Melbourne/Geelong route using either Melbourne or Geelong for the intermodal interchange into the rail network. Geelong provides potential access into the Interstate Standard gauge network and the Victorian Broad gauge network currently.

In contrast to this SSS alternative, it is projected that key road links to Hastings, including the Western Port Highway and Frankston-Flinders Road will be at or close to capacity by 2030, with the additional port traffic exacerbating capacity issues.

Consequences for the community could be:

- Reduced amenity caused by increase ambient noise levels for residences, public open spaces (road and rail)
- Reduced accessibility for local residents and businesses, on roads that become busier, leading to safety concerns, particularly where local traffic movements conflict with heavy vehicles
- Property acquisition, if new roads or rail needs to be constructed or widened
- Train movements through level crossings causing traffic delays on the roads and an increased risk of traffic accidents. With grade separated crossings likely, negative visual and noise impacts in the locality may arise.

Therefore it is possible that arbitrage opportunities for efficient intermodal exchange using SSS may not only be profitable but socially desirable.

4 Freight task and impacts of Hastings

The truck movements to cover projected container volumes (2.5 million TEU) through Hastings by 2035 (high scenario) are presented in Table 4.

Table 4 – Truck movements to / from Hastings (truck trips per day)

Road mode share	Scenario	
	Low (1million TEU / year)	High (2.5million TEU / year)
25%	300	740
50%	600	1490
75%	890	2230
100%	1190	2980

Source: POHC (2006, p 46)

A summary of truck and rail movements per day by cargo type from Hastings projected for 2035, based on a train of 1200 metres carrying 180 TEU, is shown in Table 5. The truck movements (Tables 4 and 5) to cover future (2035) container volumes (2.5 M TEU) will have a significant environmental impact.

Table 5 – Truck and rail movements per day by cargo type ex Hastings projections for 2035

	International containers	Bass Strait	Motor Vehicles	Break bulk	Dry bulk	Liquid bulk	Total
Truck moves	1500	700	200	500	350	160	3410
Rail moves	24	12	0	4	0	0	40

Source: POHC (2006, p 52)

Hastings was extensively canvassed as an alternative port to Melbourne during the public hearings on the Channel Deepening Project for access to the Port of Melbourne. Subsequently it is being considered as the deep water port to supplement the Port of Melbourne when that port runs short of capacity sometime in the future around 2030 (Port Futures 2009). A diagrammatic representation of Hastings in relation to Melbourne and key freight terminals – Dandenong, Somerton and Altona is shown Figures 2 and 3.

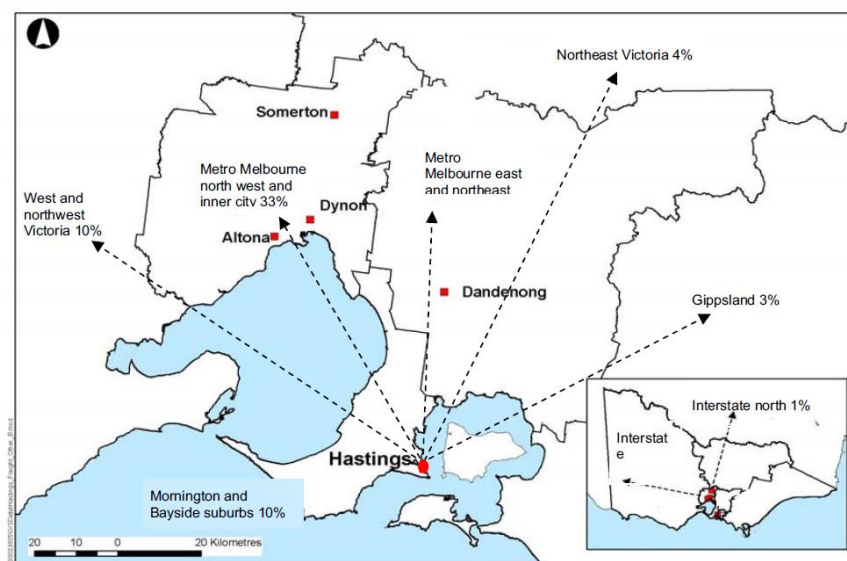


Figure 2 – Origin and destination regions for international container trade through the Port of Hastings

Note: Assuming 50% of regional cargo is processed / deconsolidated in Melbourne.

Source: POHC (2006, Figure 6.5)

Current infrastructure at Hastings (Figure 3) comprises a broad gauge spur line to the steel (Bluescope) works but no standard gauge permitting inter-state connectivity. If however it was to assume the role of a major international port then the question of access to the Port of Melbourne as well as freight depots to the west of the city (intermodal terminals) shown on the map as Altona, Somerton and Dynon and the standard gauge network would arise (Figures 2 and 3).

Transport access for freight East–West catering to both containers or break-bulk would be compelled to use a combination of road and rail if the proposed SSS alternative was not explored.

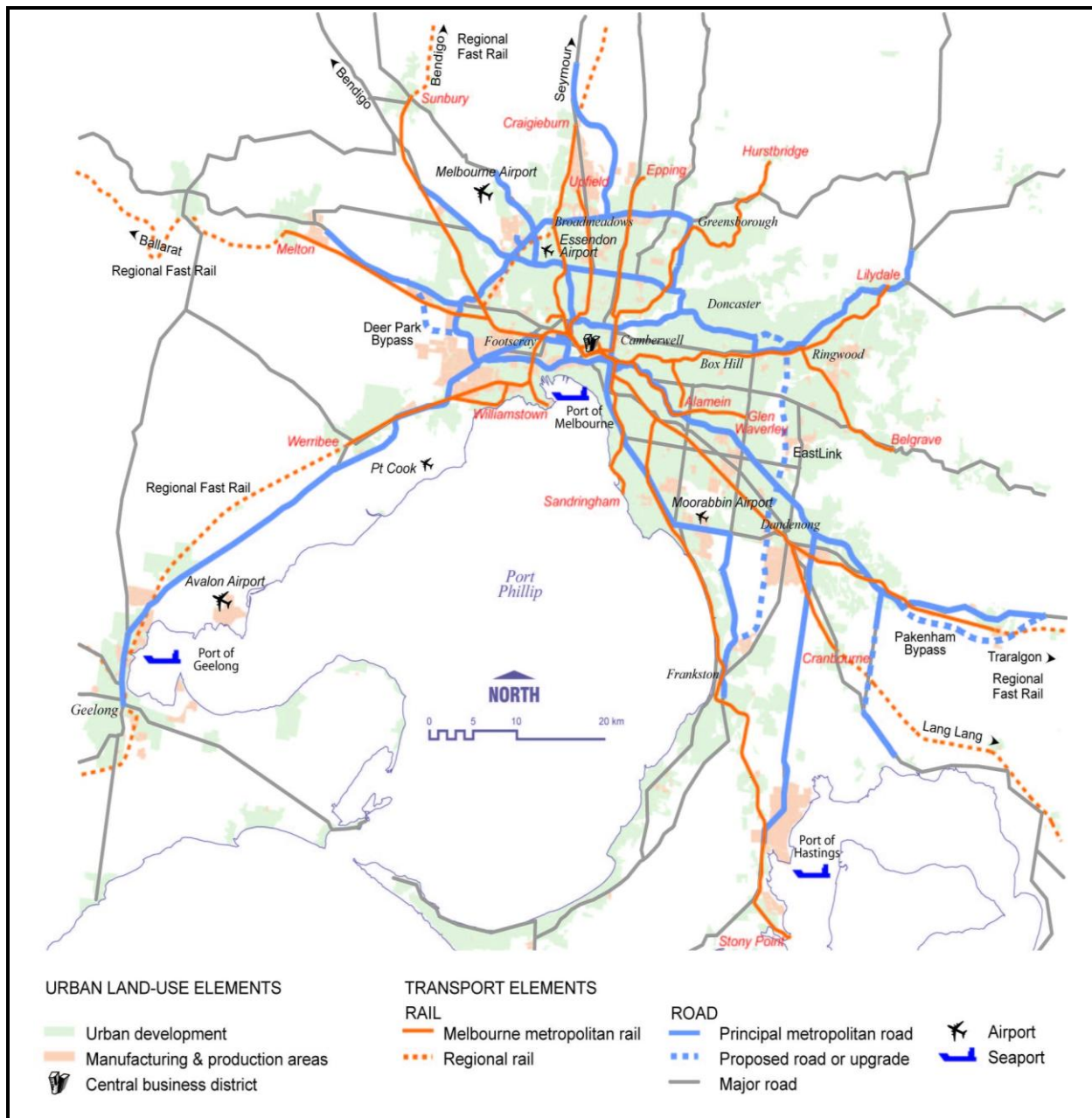


Figure 3 – Metropolitan Transport Network

Source: Department of Transport

5 Considerations and Conclusions

In considering the potential of SSS for Hastings we need to discuss operational, policy and marketing strategy issues. From an operations perspective for Hastings, only rail and road have dominated the decision framework to-date. But building rail and road to a freight standard will be very costly based on the cost estimates in the public domain for the Regional Rail Link which would require broadly similar rail works.

The Hastings freight task will be significant (POHC 2006) and therefore environmental and congestion will be an issue. Small feeder vessels of less than 200 TEU or multipurpose or barge carriers can shuttle between Hastings and Melbourne/Geelong. This is the pattern used overseas and if it works why not adopt it?

From a policy perspective the cost of access provision for rail and road together with externality for road needs to be factored in to the road cost / price equation. Consideration of an eco tax as in the EC is merited. Urban amenity is also likely to be a more contentious issue over the next 30 years. There is merit in examining the application of the “motorways of the sea” concept used in the EC. Hence we should consider favourable differential pricing for SSS at terminals catering to this mode in contrast to rail or road,

The marketing of the SSS concept is important to its successful adoption. Value adding may be captured if the terminalisation model (Rodrigue and Notteboom, 2009) is correct. Critical supply chain partnership decisions of the future which will need to be resolved are, how the provision of SSS services, will interface with terminal operators, port and transport contractors.

In order to achieve these benefits we conclude that SSS should be brought into the planning dimension and the true cost of road and rail considered. Governments at all levels and all transport operators will have important roles to play but they will need to think in innovative and creative ways. If the opportunities in this paper are grasped by supply chain managers who perceive the possibilities of unlocking value then they could work with governments to the mutual benefit of Australian trade interests. All players in the supply chain will need to be open to new ideas such as those presented in this paper. The precedent set by the Marco Polo program and the Motorways of the sea is worth considering as something which might be adapted for Victoria.

Further work is proposed, which will consider how value may be captured or unlocked in the supply chain using the SSS concept, conditions for the economic feasibility of the concept and finally the prerequisites for the political will to embrace the Motorways of the Sea concept.

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