Port and Hinterlands: The combined infrastructure costs of seaports, intermodal terminals and transport access, Port Botany, Sydney

Infrastructure Investment in Indonesia

A Focus on Ports

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5. Port and Hinterlands

The Combined Infrastructure Costs of Seaports, Intermodal Terminals and Transport Access, Port Botany, Sydney

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5.0 Introduction

From time immemorial, goods and commodities have been transferred from water to land. As specialised trade developed, such as tribute trade from Japan to China (Black and Lee 2016) primitive wharfs and harbours were created. This would also be the case with early Indonesian ports catering for the spice trade (Maguin 2017). As domestic and international trade increased in volume and ship technology improved, so did the need for more efficient intermodal transfers and space landside for port functions. Suitable deep-water seaports were located on the coast, within natural harbours or up-river but with limited thought given to landside space requirements. In the modern economy, pressures of globalisation, in particular, the widespread introduction of container ship technology from the late 1960s onwards (and associated storage, stuffing and un-stuffing containers and port access by road and rail)

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have forced governments to re-evaluate these constrained ports and seek alternative solutions (Rimmer and Black 1982) such as dry ports, or intermodal logistics terminals.

Bird (1971) has developed conceptual models of the historical evolution of port locations and developments, but the broad strategic policy options are threefold. The first is an obvious one, and that is to find an entirely new location for the port, but political pressures to capitalise on sunk investments and avoid trade going to another city often render this option infeasible. The second policy option is to reclaim land from the ocean or the bay as has been done, for example, for the Japanese Hanshin ports or Tokyo Bay (Pernice, n.d.). This option is also being followed in the expansion of Tanjung Priok, Jakarta. The third option is to transfer some of the port-associated functions into the hinterland by locating, constructing and operating intermodal terminals or dry ports (Heaver et al. 2001; Roso 2008; Roso and Rosa 2012; Panova and Hilmola 2015), as in the case of Port Botany, Sydney. Physically constrained ports with their terminal operators have become involved in developing dry ports (Roso 2009, 2008; Ng and Gujar 2009; Wilmsmeier et al. 2011; Bask et al. 2014), where the functions may be classified by distance from the port: close; midrange; and distant (Roso et al. 2009).

Whilst chosen for its distinctiveness with operational intermodal terminals, it is a fact that today there are still few ports in the world that have as many functioning close inland intermodal terminals as in metropolitan Sydney serving Port Botany (Roso 2013). This symbiotic relationship between port and hinterland, including investment costs, is examined with an historical case study. Case studies usually contain unique characteristics where some of the experience and lessons learnt are not necessarily transferable to other cities, including ports in Indonesia located in large cities.

However, the case study methodology is justified for this book chapter because Port Botany in Sydney has several close intermodal terminals already operational, and has two more that are at the advanced planning stage. What makes this case study of Sydney unique is that a major research study (Butlin 1976) anticipated the need for such intermodal facilities at the very time that containers and coal loaders were being taken out of Port Jackson (Sydney Harbour) with plans to relocate them to a new port on Botany Bay in 1969 (Black and Styhre

2015; Black and Styhre 2016). The development of Port Botany has been a continuous story of environmental (and other) conflicts from the days that container shipping was removed from Mort Bay in Sydney Harbour because of landside constraints and community action that stopped the container trucks from using narrow residential streets in Balmain (Rimmer and Tsiporous 1977). It is this historical study of conflicts (and the corresponding capital investments to eliminate such conflicts), including conflicts as recent as mid-2018 that will resonate with policy makers and researchers with the Indonesian ports of Tanjung Priok and Surabaya.

The essence of a universal problem is that increasing container volumes handled in seaports require adequate land to be available nearby for port-associated functions and they must have efficient inland multi-modal transport access. Port Botany is Australia's second largest container port handling over 2 million TEU, approximately one third of the nation's maritime containers. Container volumes are expected to increase annually over the next decade and projected to reach seven million TEU by 2031 (Transport for New South Wales 2013). Export and import of containers are rather balanced in amount of TEU, with East Asia being the leading region for full container imports. Given this growth, stakeholders have expressed concerns about the landside operations at Port Botany: they claim there are inefficiencies in the flow of containers into and out of the stevedores' premises at the port, which are resulting in congestion, particularly for road haulers. This is a general issue that resonates in other ports of the world. Issues surrounding suburban freight terminals, or dry ports, are a sub-set of the wider social and environmental problems of the interactions of seaports with their hinterlands.

In the case of seaports in metropolitan Sydney over the past five decades, we describe when the location for a new container port was selected by the New South Wales (NSW) Government to relieve the fragmented and site-constrained port facilities in Port Jackson. We also explain why this sub-optimal location on Botany Bay had insufficient land available for its longer-term expansion. The historical backdrop is important for researchers to understand port locational decisions. The location in the 1970s was predicated on road haulage serving the new port but subsequent governments have changed policy to encourage a mode

share of 40% on rail so the whole issue of hinterland transport access is examined in some detail. Part of recent government policy has been to boost intermodal logistics terminals in metropolitan Sydney. However, the case study of Moorebank (maximum capacity of two million TEU), which started in 2003 with operations to commence soon, demonstrates that has not been without controversy. Moorebank Intermodal Terminal is one example of a Public Private Partnership infrastructure project in its development and financing and so the traditional role of governments managing and funding ports is examined through both the privatisation of Port Botany and through the national government's encouragement of asset recycling. The conclusions contain broad port and hinterland issues that require careful consideration in the Indonesian context.

5.1 Methodology

The methodology adopted in the study of implementation and financing of new container ports and dry ports is as follows. To set the context for the case study of metropolitan Sydney, we compare recommendations associated with resolving the Port Botany's environmental and social problems in the 1970s against how successive governments have formulated (palliative) policies based on comprehensive research by Butlin (1976), Rimmer and Black (1982), Black and Styhre (2016), and other government and private-sector inquiries (for example, NSW Parliamentary Librarian 1976; NSW Government 1980a,b, 2011; Infrastructure Partnership Australia 2007). Infrastructure costs are derived from various sources including project websites and New South Wales Department of Treasury annual budget appropriations.

An extensive review of the literature on dry ports was undertaken to include in this chapter. This archival research is supported by studies based on in-depth interviews with key stakeholders on ports and dry ports (Roso 2008; Roso 2013; Roso et al. 2015). Interviews in these studies have been undertaken with different actors of the transport system, such as seaport managers, inland terminal managers, rail and road operators, as well as policy makers. In addition, secondary data sources, such as internal company reports and internet-based documents, were combined with site visits in order to ensure validity through triangulation (Golicic and Davis 2012).

5.2 Literature Review Intermodal Terminals — Concept of Dry Ports

Intermodal transport refers to the freight supply chain using at least two different modes of transport for the movement of intermodal units (containers, semi-trailers or swap bodies) between origin and destination with one bill of lading, i.e. without handling freight itself during transhipment (Rutten 1998; van Klink and van de Berg 1998; Nierat 1996). Reduced energy consumption, optimisation of the usage of the main strengths of each mode (European Commission 2000a), reduction of congestion on road networks, and low environmental impacts (Woxenius et al. 2004; Kreutzerberger et al. 2003) are considered to be the advantages of intermodal (road-rail) transport.

There is a substantial body of research available on how to find the optimal location for these terminals (Rutten 1998; Macharis and Verbeke 1999; Arnold et al. 2004; Flämig and Hesse 2011; Wang et al. 2017) and how to improve the efficiency of the road-rail terminals (Kozan 2000; Ballis and Golias 2002; Awad-Núñez et al. 2014). Höltgen (1995) deals with the basic problem of differentiation between "conventional" transhipment terminals and the various types of large-scale, intermodal logistics centres. The definitional issue is that the concept for intermodal logistics centres varies from country to country. A substantial amount of research has been completed, in general, about the concept (Roso 2008; Roso et al. 2009; Ng and Gujar, 2009; Notteboom and Rodrigue 2010; Rodrigue et al. 2010; Veenstra et al. 2012; Roso 2013). Inland intermodal terminals should: contribute to intermodal transport; promote regional economic activity; and improve land use and local goods distribution. These features may also be applied to a dry port — an inland intermodal terminal that has direct rail connection to a seaport, and where customers can leave and/or collect their goods in intermodal loading units, as if the transaction was directly with the seaport (Roso et al. 2009). As well as transhipment, which a conventional inland intermodal terminal provides, services such as storage, consolidation, depot, track and trace, maintenance of containers, and customs clearance are available at dry ports.

The quality of access to a dry port, and the quality of the road-rail interface, determines the dry port's performance (Bask et al. 2014).

However, the quality of inland access depends on the behaviour of a large variety of actors, such as government planning agencies, regulatory authorities, terminal operators, freight forwarders, transport operators, and port authorities and this requires coordination between all actors involved (de Langen and Chouly 2004; Van Der Horst and de Langen 2008). Scheduled and reliable high-capacity transport by road and rail to and from the seaport is a prerequisite. Bergqvist et al. (2010) identified factors affecting the development process and the time needed to establish intermodal road-rail terminals: profitability; financiers; political entrepreneurs; location; large local shippers; and the road traffic authorities. The authors conclude that profitability, combined with an enthusiastic and committed political entrepreneur, are the most vital factors for the success and pace of the development process (ibid). Haralambides and Gujar (2011) argue that Public Private Partnership investments should be supported by governmental pricing policies and guidelines to secure successful dry port implementation. Implementation of a close dry port in a seaport's immediate hinterland increases the terminal capacity of the seaport and with it comes the potential to increase productivity because larger container ships will be able to call at the seaport (Roso et al. 2009; Black et al. 2018), provided that the seaway is not constrained by the necessary draft depth.

With a dry port implementation, the seaport's congestion from numerous trucks at the landside interface is avoided because one train can substitute some thirty-five trucks (in the European context as noted by Roso et al. 2009). The benefits from dry ports derive from the modal shift from road to rail, resulting in reduced congestion at the seaport gates, and their surroundings, as well as reduced external environmental effects along the route (Roso 2007; Roso et al. 2009; Lättilä et al. 2013). A reduced number of trucks on the roads generates less congestion, fewer accidents, lower road maintenance costs and less vehicle emissions; as much as 25% (Roso 2007) and 32–45% (Lättilä et al. 2013) less emissions. A study conducted in Finland concludes that implementation of dry ports would cause "reduction in both, emissions and total transportation costs" (Henttu and Hilmola, 2011). Although road carriers would lose market share, in countries such as Australia, where long trailers are restricted to pass through city roads, a dry port is a good solution from their perspective as well. In addition to the general benefits to the

environment, and the quality of life for residents by shifting container flows from road to rail, the dry port concept mainly offers seaports a possibility to increase their throughput without physical expansion at the site of the port. It therefore constitutes a "movement" of the seaport's "interface" inland (Roso et al. 2009) and, effectively, extends the reach of the seaport inland (Wilmsmeier et al. 2011).

The concept of a dry port should facilitate more efficient port access. The movement of the seaport's interface inland shifts container flows from road to rail. This results in a reduction of road transport to and from the seaport, along with the broad social and environmental benefits associated with such a reduction (Henttu and Hilmola 2011; Hanaoka and Regmi 2011; Roso 2013, Black et al. 2018). Various types of inland intermodal terminals that fit into the concept of dry ports have been developed and studied around the world, for example in China (Beresford et al. 2012), Japan (Yoshizawa 2012), India (Ng and Gujar 2009), the United States (Rodrigue et al. 2010; Roso et al. 2015), Asia (Hanaoka and Regmi 2011), Russia (Korovyakovsky and Panova 2011), Australia and New Zealand (Roso 2008 and 2013; Black et al. 2018) and Europe (Flämig and Hesse 2011; Henttu and Hilmola 2011; Monios 2011; Bask et al. 2014).

As noted above, success in the development of seaports, and of inland terminals, depends on the behaviour of a large variety of actors. However, the devil is in the detail when it comes to co-operative behaviour and co-ordination with real-world examples. In practice, locating dry ports within an already developed metropolitan space, such as Sydney or Jakarta, is a tricky balance between evidence-based land-use and transport analysis and the politics at the local, metropolitan, state and national scales. In order to understand suburban terminal location issues in metropolitan Sydney we must first explain the historical context.

5.3 Sydney's Container Ports — History

Sydney was a port at Sydney Cove before it became a city. When the First Fleet of nine ships entered Port Jackson on 26 January 1788 to establish a penal colony for British convicts that became the first European settlement on the continent, British Government policy was

to establish friendly relations with indigenous Australians, but it was not long before conflict erupted (Australian Museum 2015; FitzSimons 2019). Subsequent urban evolution reflects the multiple ripple effects caused by dis-equilibrating external influences, induced in the 19th and 20th centuries largely by the changing nature of world capitalism. Domestic responses to the container ship revolution have only partially resolved re-occurring conflicts (Rimmer and Black 1982, p. 230). From the late 1960s to the present day, these responses have taken the form of infrastructure developments — essentially shifting problems from one place to another — where "the community has a limited capacity for absorbing spatial dissonance" (Rimmer and Tsipouras 1977, p. 12).

The port systems of Sydney have developed rapidly since the 19th century in response to a continuing sequence of external stimuli and Australia's changing role in the world economy. The Australian Federal Government held a Conference on Containerisation in 1966 to seek assistance from the State port authorities (Under the Australian Constitution, maritime commercial ports are the statutory responsibility of state and territory governments) in providing facilities for containerised cargo, mitigating the effects of the reduction in water-side employment and minimising inter-union disputes. In Port Jackson it turned out to be a problem of lack of land availability for container operations. As a consequence, the Maritime Services Board (MSB — the Sydney port authority at the time), "became committed to the redevelopment of port facilities to cater to the new order" (Brotherson 1975, p. 34).

Initially, Port Jackson was partially redeveloped with the first container terminal (leased to a British consortium (Seatainer Terminals Pty. Ltd)) opened in 1969 at White Bay on 10.9 hectares of reclaimed land. A 10.1-hectare MSB facility on Glebe Island was opened in 1973. Although the Commonwealth Government suggested these facilities would be adequate for "the foreseeable future", it was later conceded that these two terminals were half the area required. This necessitated decentralised depots at Villawood and Chullora for container handling. In turn, this aggravated strife between the Waterside Workers Federation of Australia and the Federated Storemen and Packers Union over who should handle containers in off-wharf depots — the court decision going in favour of the latter union. The third container port in Port Jackson at

Mort Bay had a depth of water of 9.5 m that proved insufficient for the second generation of container ships that were introduced in 1975. The fourth container terminal was at Darling Harbour.

Mort Bay faces northeast onto Sydney Harbour on the Balmain peninsula where the predominantly residential and industrial streets have 10m-wide road pavements feeding onto the only main road into and out of the peninsula — Darling Street. Not surprisingly, the container movements by trucks met with great hostility from residents of Balmain and Rozelle, who complained vocally that the Maritime Services Board had approached the planning for containers from a narrow, "silo" maritime perspective. This situation led to the preparation of a report by residents arguing for the earliest elimination of cargo trucking through Balmain. The report cited evidence of pedestrian accidents, noise intrusion, pollution, structural damage to pavements, fear of damage to parked cars, and a 5 to 10% drop in property values along truck routes. Australian National Line figures indicated that approximately 1000 trucks moved in and out of Mort Bay during a sixty-six-hour working week. In November 1974, Mort Street residents counted up to seventy-nine trucks per hour during peak periods (Rimmer and Black 1982, p. 237).

The environmental backlash was so severe that Australian National Line (ANL) quit the congested site at Mort Bay in April 1980 for Port Botany which offered improved "operational and environmental conditions" (Rimmer and Black 1982, p. 237). (The importing of cars by ship that previously occurred at Glebe Island was relocated to Port Kembla in November 2008.) Forewarned by the confrontation between residents of Balmain and ANL, the residential community of Botany, located around the new port on Botany Bay, feared similar environmental issues when that port became operational.

In 1978/9, 69% of all general cargo was containerised with 349,337 TEU containers annually passing through these four terminals in Port Jackson (Rimmer and Black 1982, Table 12.2, p. 231). A survey in June 1978 showed that on a typical day, 650 containers were moved by road and 450 containers were moved by rail (Edgerton et al. 1979). The truck traffic generated by the containers in Port Jackson and Port Botany inevitably led to conflicts with surrounding residents and with other road users, especially during the morning peak-hour. As a New South

Wales Government Inquiry noted, the "container vehicle, even in a sea of cars, stands out as an elephant amidst a flock of pigeons" (NSW 1980a, vol. I, p. 89).

5.4 Port Botany Container Terminals

It was the unanticipated growth of container traffic through Port Jackson, and the environmental backlash from resident action groups on the Balmain peninsula, that forced the government to review its plans for Port Botany and to incorporate container terminals there. Brotherson (1975) explains the relevant history behind the need to relocate some port functions from Sydney Harbour to an entirely new port on reclaimed land in Botany Bay. Port functions to handle containers in Port Jackson were becoming increasingly constrained in the post-Second World War era because of the lack of suitable land to store full and empty containers. The NSW State Government wanted to maintain Sydney as Australia's premier port, so a decision was made in 1969 to construct container facilities in Botany Bay. Table 5.1 gives a time line of key events.

Table 5.1 Port Botany — Key Events 1969–2018 (Table by the authors)

Date	Key Events
1969	NSW State Government decision to construct container facilities in Botany Bay
1971	The NSW Government establishes the State Pollution Control Commission (SPCC) but with no regulatory powers
June 1971	Construction of Port Botany commences on 600ha of reclaimed land in Botany Bay
November 1974	SPCC takes over regulatory functions of water and air and regulation of municipal garbage disposal from the NSW Health Commission
1976	Publication by Professor Noel Butlin of book on the impact of Port Botany Bay
1979	NSW Environmental Planning and Assessment Act became law whereby development proposals, such as ports and intermodal terminals are scrutinised in the public arena through environmental impact assessments
December 1979	Port Botany opens

Date	Key Events
30 June 1995	Maritime Services Board was abolished under the *Ports and Maritime Administration Act 1995*, and Sydney Ports Corporation was established
September 2011	NSW Government announced its intention to refinance state owned assets including Port Botany
12 April 2013	99-year lease of State-owned port assets Port Botany and Port Kembla awarded to the NSW Ports consortium.
September 2018	Cruise Ship Terminal mooted for Port Botany after Federal Government rules out Garden Island as a suitable terminal location

Construction of Port Botany started in June 1971, the years before environmental impact assessment and subsequent public inquiry became NSW Government policy. The new port involved the physical transformation of Botany Bay through dredging, construction of a high breakwater to counter storm surges in the bay and reclamation of a large area at a cost of about AUD 621 million (in 2016 prices). A V-shaped entrance channel 19.2 m deep was dredged in the mouth of Botany Bay to accommodate 200,000 DWT tankers ostensibly designed for petroleum imports and bulk cargoes. In 2018, the maximum draught remains at 12.7 m. Hence, the northern foreshore of the bay involved reclamation of about 225 hectares of land and a re-entrant basin dredged to 15.3 m of depth with nearly 2 km of wharfage to accommodate two container terminals, each with three berths (Fig. 5.1).

From the outset, The Botany Bay Project established by the Australian Academies (Science, Social Science and Humanities) criticised the government's decision to relocate container facilities to this location because it disregarded:

> the land-use impact on the hinterland, the effects on city design, the social disturbances to city residents, the efficiency and economic rationality of the investment project and the social implications for the land environment (Butlin 1976, p. 94).

The Botany Bay project drew attention to several issues that have haunted Port Botany operators from the 1970s to the present day: the area's poor landward connections to the emerging industrial lands in

Fig. 5.1 Port Botany Container Terminals. Source: https://www.nswports.com.au/assets/Uploads/PDFs-General/MAP-PB-New-for-website.pdf

the outer western suburbs of Sydney; the area's limited rail access to the port; and constraints imposed not only by its location (immediately to the port's north-west is Sydney International and Domestic Airport), but also, significantly, by community intolerance. The present-day pattern of container truck movements is illustrated in Fig. 5.2, where projections show a similar spatial pattern of intensified traffic in 2036.

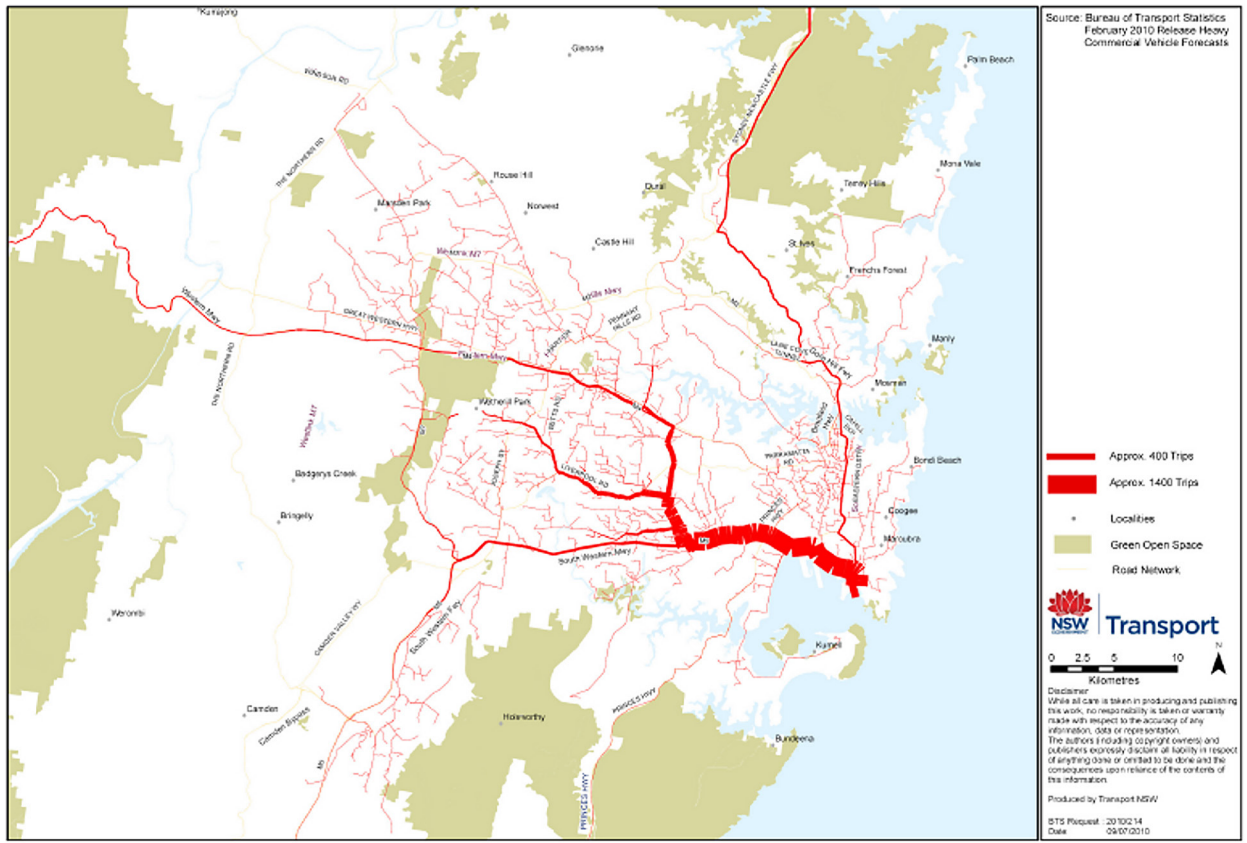

Fig. 5.2 Heavy Commercial Vehicles Trips from Port Botany, Average Weekday, 2006. Source: Bureau of Transport Statistics 2010.

The growth in container traffic has forced local councils around the port to react with specific zoning policies, while the co-location with Sydney Airport has imposed additional pressures on land. The County of Cumberland Planning Scheme (1951) recognised the growing importance of Sydney Airport and Port Botany combined as a centre of economic activity and generator of traffic activities in the future, at a time when international shipping was the dominant mode for passengers and cargo. The document then suggested the need for allocating some extra space within, and in close proximity to the port and airport in order to accommodate these activities. The scheme zoned a total area of 308.44 hectares to be used as port and airport-oriented land-uses.

The local government Interim Development Order no. 19, which was enacted on 16 September 1977, allocated another 80 hectares of land in the surrounding areas of Sydney airport for airport-related land-use (Jatmika 2001). At this time, other parcels of land still followed the land-use zonings stipulated in the County of Cumberland Planning Scheme. In 1987, the Botany Local Council issued Local Environmental Plan (LEP) no. 32 as the main instrument for the land-use development planning and control. The major aims of the LEP were: to encourage local economic development; to provide efficient public services and amenities; to promote better environmentally-based development; and to encourage port and airport-related economic activities. The specific objectives were: to promote airport-oriented business as the major activity, whilst accommodating some seaport-associated activity developments; to foster a mixed-use of land for those industrial activities that are compatible with airport-related industries; to improve the landscape and streetscape of the zone; and to discourage traffic-generating land-use development within the zone.

The spatial pattern of change caused by the gateway port-dependent industries (such as cargo services, customs broker, transport and forwarding agents, warehouse, courier, airline and sea liner agents, importers, export agents, transport service and shipping companies) in the adjacent municipality to Sydney port and airport — Botany Municipality — has provided the basis for research policy analysis. In the designated study area, where fieldwork and interviews were undertaken in 1971 (Black et al. 2012), general industry dominated: only two carrier firms (out of twenty-eight firms) were related to gateway

port activities. These two companies accounted for 8% of all firms. It was only after the establishment of the LEP in 1987 that the number of port and airport-related firms increased significantly. The number of port and airport-related sites accounted for only 8% in 1971, increased to 29% in 1991 and 43% in 2001. By 2011, the port and airport-related sites accounted for sixteen sites (46% of the total sites). In 2009, Botany Bay Council issued the Botany Bay Planning Strategy 2031 stating unequivocally that both Sydney Airport and Port Botany have a national economic significance and will continue to become one of the Australia's gateway ports in the future (SGS Economics and Planning 2009).

In maintaining the port as a global gateway, an uneasy tension in the aspirations of the Botany Bay Planning Strategy arises between, on the one hand, ensuring employment areas near the port are protected and are able to accommodate port-related activity and businesses, and, on the other hand, ensuring port activities do not further compromise residential amenity. The growth of gateway port activities will require extra space to cater for the increasing demand for off-site employment sites. This expansion compromises the amount of land available for residential development and undermines the state government's policy on increasing residential densities throughout inner Sydney. Only around 108 hectares of the local government area (LGA) is comprised of unconstrained residential land (SGS Economics and Planning 2009, p. 6). This unconstrained residential-zoned land comprises only one third of the total residential-zoned land in the whole of the Botany Local Government Area. Without careful planning, increased port activity and related truck and rail freight traffic will impinge on future residential amenity. The strategy suggests that additional residential development should be directed to areas away from the rail freight corridor and truck routes. It further suggests that areas already affected should be considered for alternative, non-residential zoning over time (SGS Economics and Planning 2009, p. 78).

The New South Wales Government has aspirations to make Port Botany the largest container port in Australia. Recently, Port Botany underwent a major expansion of its container port facilities to cope with the growing volumes of trade. The expansion — one of the largest port projects ever to be undertaken in Australia in the last 30 years — entailed the design, construction, procurement and the eventual awarding to

Hutchison Port Holdings (HPH) of the 3rd Stevedore contract (NSW Ports 2015). The NSW Government then called for long-term leases for the operation of two of Australia's largest ports. Port Kembla is Australia's largest vehicle import hub and the largest grain-handling terminal in New South Wales and Port Botany is the country's second largest container port.

The New South Wales Government retains regulatory oversight of port matters, and the Australian Competition and Consumer Commission (ACCC) has established a price-monitoring regime to ensure transparency as Port Botany is now operated by the private sector. The successful private sector partner was NSW Ports, who obtained the concession for ninety-nine years. The winning consortium — IFM Investors, AustralianSuper, QSuper and Abu Dhabi Investment Authority — made an upfront payment of AUD 5.07 billion: AUD 4.31 billion for Port Botany and AUD 760 million for Port Kembla (Infrastructure Australia 2014, p. 22). In addition, the consortium pays an annual fee of AUD 5 million to the State Government under the lease agreement. The proceeds are allocated to the State Government's investment fund, Restart NSW, to help pay for large infrastructure projects (including the 33 km-long WestConnex roads project) under the policy of asset recycling. In September 2018, the Sydney Transport Partners consortium, led by Transurban (who operate seven of Sydney's existing toll roads) paid AUD 9.3 billion to the New South Wales Government for a 51% share of the motorway that is expected to open for traffic in 2023 (Saulwick et al. 2018).

5.5 Multi-Modal Transport Access to Port Botany

The relocation of port activities from Port Jackson to Port Botany altered the modal split of containers to and from Sydney Ports, because the terminals at Port Botany were designed for trucks. When fully operational, 53% of the containers previously carried by rail to and from Port Jackson were transferred to truck to and from Port Botany. Furthermore, there was a shift in the orientation of trip patterns with container trucks moving westwards through Rockdale where the alternative routes were unsuitable for heavy vehicles. The arguments made by import/export companies at the time were that either

container traffic does not cause any environmental problems, or if they do, "operational, practical and financial considerations would make alternatives less desirable, if not impractical" (Rimmer and Black 1982, pp. 239–40).

Naturally, local government councils in the Botany Bay sub-region strongly opposed the projected flows of containers through their municipalities and pressure mounted on the NSW State government for the greater use of rail instead of new road construction. The State Rail Authority proposed two options: that 70% of containers could be carried by rail by establishing depots inland from the port at Cooks River, Rozelle, Chullora and Villawood; or that containers with origins and destinations in a defined zone in the outer western suburbs be trucked to Chullora and Villawood then with a rail connection to Botany Bay. The Commission of Inquiry into the Kyeemagh-Chullora Road (NSW 1980a), which examined the major road deficiencies linking the new port with industrial areas, eventually recommended the latter, rail-based scheme be adopted. This recommendation was never implemented.

The current Sydney Freight Network with access to Port Botany via the Botany Goods Line is shown in Fig. 5.3. The Australian Rail Track Corporation (ARTC) and the NSW Rail Corporation (now Sydney Trains) signed a Deed of Agreement for the Metropolitan Freight Network (MFN) Lease and License. In December 2008, ARTC commenced the first phase of the MFN lease, with the lease of the Port Botany Rail Yard. Subsequent leases for Enfield West to Sefton and Port Botany to Sefton Park Junction were executed in July 2011 and August 2013, respectively. The timing of the MFN leases generally coincided with major capital projects (ARTC 2015, p. 3).

For example, ARTC developed, as a potential candidate for funding from the Nation Building Program 2009–2014, a staged upgrading program for the Metropolitan Freight Network and Port Botany line to meet projected growth in demand for container transport by rail. This proposal was successful (Infrastructure Australia 2018). The Port Botany Rail Link (PBRL) project is in two phases. A third phase has now been funded under the current Infrastructure Investment Program. A Federally funded AUD 75 million project — Stage 3 upgrade of the 18 km South Sydney Freight Line — involving track

reconditioning, concrete re-sleepering, new rails, new drainage and new retaining structures is due for completion in 2019. The 2018–2019 Federal Budget, announced on 4 May 2018, allocated AUD 400 million including new rail bridges, civil works and duplicated rail tracks across the 2.9 km length of the freight line between Mascot and Botany, along with the construction of a 1.4 km passing loop between Cabramatta and Warwick Farm. When completed by the Australian Rail Track Corporation Ltd, the project will support freight logistics and supply chain activities of existing intermodal terminals such as at Enfield and Chullora and Moorebank (under construction) (http://roadsonline.com.au/port-botany-rail-line-to-undergo-400m-upgrade/).

In addition, the Port Botany Expansion Project entailed the design, construction, procurement and eventual awarding to Hutchison Port Holdings of the 3rd Stevedore contract. This part of the Project has now been completed and Hutchinson commenced operations from the 3rd Terminal in 2014. NSW Ports has begun investigating future requirements at the Port Botany Rail Terminal to receive a greater number of train movements. Investigations include the future construction of multiple rail mounted gantries (ARTC 2015, p. 6).

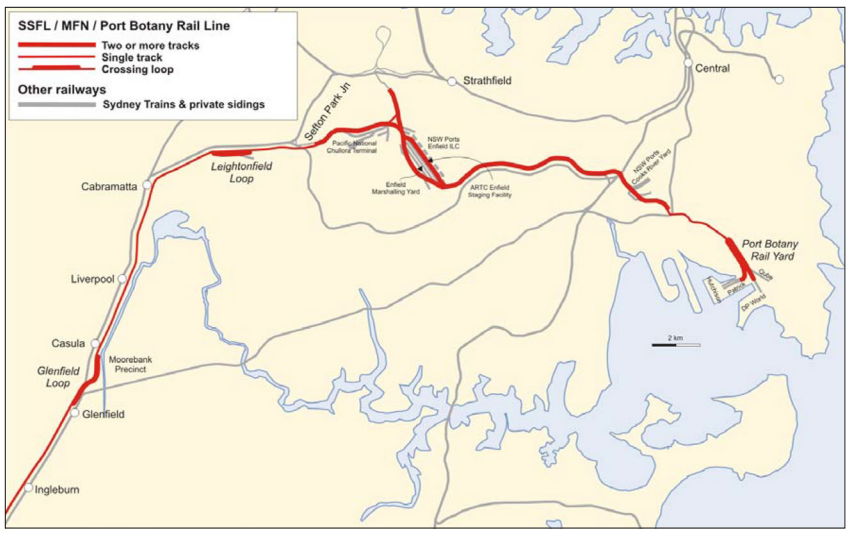

Fig. 5.3 Southern Sydney Freight Network and Port Botany Rail Line.
Source: ARTC 2015, Fig. 1.2, p. 6

However, the transport industry has stridently opposed the imposition of any regulations on the choice of transport mode for containers. For thirty-five years, inadequate truck routes accessing Port Botany continue as an unresolved problem. In 2011, around 20% of containers were carried into and out of Port Botany by rail — well below the state government's target of 40% set in 2005 for 2011. The Botany Bay Planning Strategy 2031 suggests that the port will be at its most competitive and efficient where support infrastructure such as heavy truck routes and arterial roads, and rail infrastructure, provide ease of movement to and from the facility. It further suggests that infrastructure investment will deliver that promise within the next decade.

The Independent Pricing and Regulatory Tribunal of New South Wales (2008) reviewed the interface between the stevedores and the haulage companies, recommending options for improving efficiency. These options included the use of road instead of rail, where rail is constrained by track configurations within the port terminals; and the finding of suitable train paths through the metropolitan rail network. Improvements to the vehicle booking system (VBS) operated by the stevedores and the introduction of the Port Botany Landside Improvement Program, introduced through regulation in February 2011, largely eliminated the truck queues that had previously extended around the port precinct where waiting from two to four hours was common (NSW Freight 2013).

The Federal Government has intervened in this long-standing wrangle between State and local governments. For many decades, the State and Territory Governments have been the key players in the port planning process, wherein both Federal and Local Governments have a relatively low level of involvement. Uncoordinated port planning and development, as identified above, has caused trade barriers and relatively high transaction costs as well as inefficient funding allocations. The main objectives of the national ports strategy are: to promote sustainable port development by enhancing port-related freight movements; to minimise the negative externalities of the freight movements; and to influence the policy making process associated with freight movements. There are four crucial issues that need to be dealt with for all Australian ports:

- Effective legal and governance frameworks.
- Land-use planning enhancement and the preservation of a transport corridor.
- The future requirements of port facilities, involving road and railway lines.
- Future planning and development of port and freight facilities which is coordinated nationally.

The road strategy is illustrated in Fig. 5.4. The recent sale of the WestConnex Motorway to Transurban will provide the NSW Government with money to build the Airport road link under its Assets Recycling Policy.

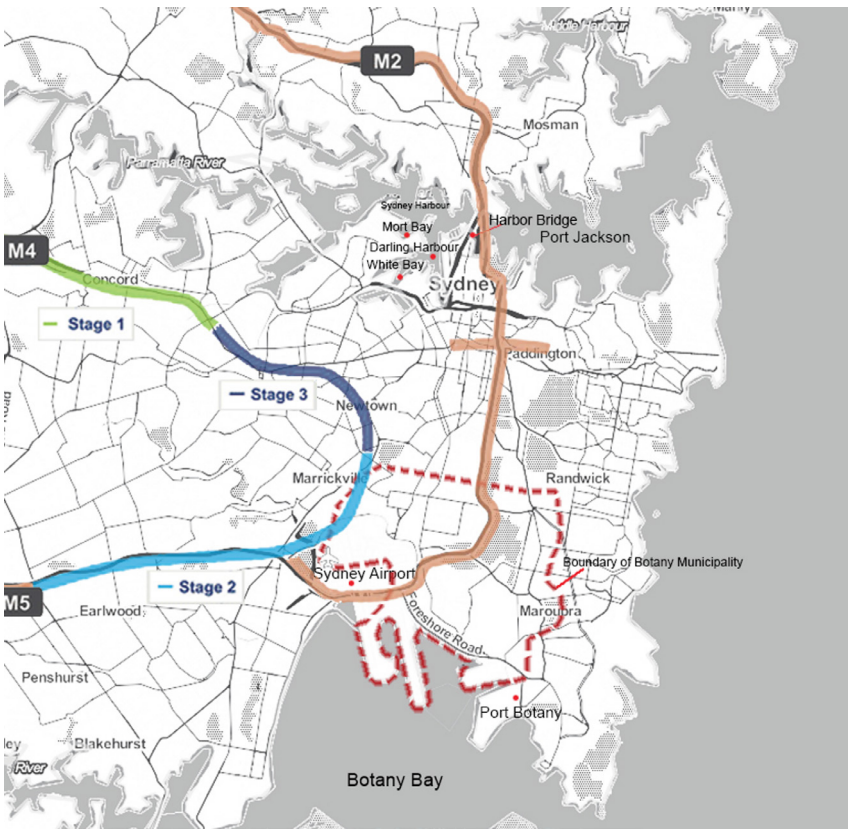

Fig. 5.4 Motorway Connections Proposed Between Sydney Airport and Port Botany (Figure by the authors)

5.6 Hinterland Intermodal Logistics Centres

In order to implement the above policies and strategies for developing Port Botany, the NSW Government allocated AUD 483 million to develop a network of Intermodal Terminals, such as the enhancements of Botany and Enfield Rail Yards (NSW Transport and Infrastructure 2010). The main target of the development is to increase the share of container consignment by rail to 40%. The growth of trade activities and container flows will also increase the demand for land to cater for the economic development. The NSW Government, through its Freight Strategy, endorsed a plan for a new network of intermodal terminals to support the movement of containers by rail. The new terminals will supplement the existing capacity, and reduce delivery times and costs. The areas identified as intermodal sites include Enfield, Moorebank and another site in western Sydney that is yet to be identified.

5.6.1 Port Botany's Inland Terminals Pre-2010

Several intermodal terminals that were located within the Sydney metropolitan area nearly a decade ago are listed in Table 5.2. These are primarily located in close proximity to areas of concentrated industrial distribution. The total planned capacity is limited in some cases by the availability of freight train paths through the Sydney metropolitan network. The total estimated capacity of these terminals is about 695,000 TEU. These intermodal terminals service the port or function as a transfer point for interstate cargoes. Sydney Ports Corporation (2008) recognised the need to expand the intermodal network within Sydney as a prerequisite for the greater use of rail in alignment with an NSW Government transport policy objective — in fact, the expected capacity for TEU containers has increased by over 5.5 times. The NSW Government Metropolitan Strategy outlined a proposed network of additional intermodal terminals in the central-west, south-west and west of metropolitan Sydney to meet predicted demand (Sydney Ports Corporation 2008).

The NSW Government proposed new facilities at Enfield, Moorebank and Eastern Creek. Sydney Ports Corporation developed a proposal for an Intermodal Logistics Centre at Enfield that provides an intermodal facility to cater for demand generated in central-west Sydney (Table 5.3).

Table 5.2 Metropolitan Sydney intermodal terminals, 2008

Location	Operators	Siding Length (Metres)	Estimated Capacity (TEU)
Camellia	Patrick PortLink	300	80 000
Chullora	Pacific National (inter-state)	680	300 000
Cooks River	Maritime Container Services	500	150 000
Villawood	Mannway	350	20 000
Minto	Macarthur Intermodal Shipping Terminal	390	45 000
Yannora	Patrick PortLink/QR National	500	50 000

Source: Sydney Ports Corporation (2008).

The private sector proposed an expansion of the Macarthur Intermodal Shipping Terminal at Minto and a joint venture arrangement between Kaplan Investment Funds, QR National and Stocklands for a new intermodal facility at Moorebank. The inclusion of warehousing and freight support services within each site is a mitigation strategy to reduce the number of large truck movements within the local community surrounding the terminal facilities.

Descriptive details of each terminal follow, while a broad overview of their TEU capacity is supplied in Table 5.3.

Table 5.3 Sydney suburban intermodal terminals — TEU capacity

Location	Operator	Capacity* TEU	Comments
Chullora	Pacific National	600,000	Announced in 2015 increasing from 300,000 to 600,000.
MIST	Qube	200,000	Capacity as stated on Qube website.
Cooks River	MCS	500,000	NSW Ports advice.
Yennora	Qube	200,000	Qube advice.
Villawood (Leightonfield)	Toll/DPW	180,000	Toll / DP World announcement.

Location	Operator	Capacity* TEU	Comments
Enfield	NSWPorts	500,000	Planning approval for 300,000.
Moorebank	Qube	1,550,000	Planned to commence operations in 2017. IMEX and interstate.
Total		3,730,000	

Source: ARTC (2015), Table 2.1, p. 13

The existing and proposed terminals are shown in Fig. 5.5.

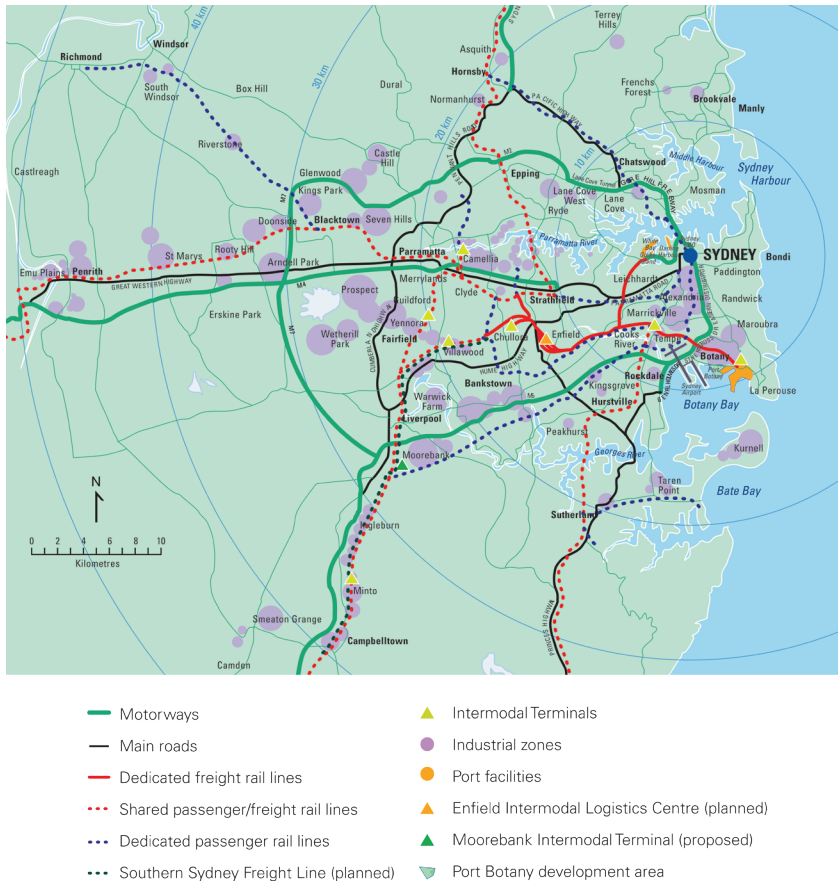

Fig. 5.5 Location of existing and proposed freight terminals for Port Botany
Source: Sydney Ports Corporation 2008

5.6.2 Chullora Intermodal Terminal

Chullora, Pacific National's facility, is the main interstate terminal geographically close to the centre of the city, located immediately to the south of the Sydney Operations Yard. However, the drift of freight intensive activity to the west and south means that it is effectively to the east of the major industrial concentrations. The terminal is situated about 25 km from Port Botany and has four 680 m-long rail sidings that accommodate about forty trains a week, resulting in a total throughput of 300,000 TEU/year (Sydney Ports Corporation 2008; Roso 2013). In 2015 that capacity was doubled. The facility is equipped with two gantry cranes; however, it does not offer customs clearance since it is used only for domestic freight movements (Roso 2013). Two new rail mounted gantries were commissioned earlier in 2015, increasing the capacity of the terminal from 300,000 to 600,000 TEU/year where the plan is to use the terminal for import/export containers (ARTC 2015). This facility can receive 1500 m trains for break-up and shunting into the terminal itself. Expansion of the terminal is complicated due to the presence of endangered species around the site and interaction with the RailCorp facilities to the east.

5.6.3 Macarthur Intermodal Shipping Terminal (MIST)

The Macarthur Intermodal Shipping Terminal (MIST) site located at Minto is a 16-hectare intermodal facility that has an annual throughput capacity of up to 200,000 TEU. In 2012, Qube acquired MIST from the Independent Transport Group (ITG). As part of the transaction Qube acquired the freehold property at Minto with warehousing and its rail terminal, locomotives and wagons from ITG (ARTC 2015). The terminal is entirely privately owned and run by MIST who saw the potential in using rail for the transport of containers to the seaport, and, in agreement with the seaport, but with its own investments, started a rail shuttle to/from the seaport. Services offered at the terminal are container haulage and transshipment between rail and road, storage, warehousing, maintenance of containers, customs clearance, quarantine, reefer storage, and packing/unpacking (Roso 2013). The 45 km-long shuttle services (approximately 4 per day) currently operate on the Sydney rail network between Minto and the connection to the

metropolitan freight network at Sefton Park Junction. The terminal's throughput is about 65,000 TEU a year (in 2010), of which one third is for exports. Besides the rail connection to the seaport, the terminal has rail connections to other inland terminals where empty containers (from the seaport) are dispatched to be filled with grains for export (Roso 2013). On its 600 m-long rail sidings the terminal is able to accommodate long trains that will result in increased rail volumes. There is about 25,000 m^2 of covered storage in use and an additional 10,000 m^2 of warehouse.

5.6.4 Cooks River Intermodal Terminal (St Peters)

The Cooks River Intermodal Terminal is adjacent to the dedicated rail freight line 10 km from the port and is owned by NSW Ports and operated by Maritime Container Services Pty Limited (MCS). The 17.3-hectare intermodal terminal and empty container site with 14,500 TEU capacity was purchased by Sydney Ports in October 2005 and is currently utilised by container operators. The Cooks River Rail Depot and Empty Container Park (ECP) at St Peters receives empty containers from importers to be cleaned, stored and repaired before being sent for export loading or empty export. With 150,000 TEU throughput, the facility contributes to the port's strategy to manage the growth of containers by rail (Roso 2013). During 2012 work was undertaken to upgrade and expand the Cooks River facility. This has included the extension of existing rail sidings to allow for trains of 600 m in length.

5.6.5 Yennora Intermodal Terminal

Yennora Intermodal Terminal, operated by Qube, is located about 30 km from Port Botany in the Western suburbs between Granville and Liverpool on the main southern railway line. There are two 530 m-long rail sidings, and the total storage capacity for the facility is 5,000 full and 9,000 empty containers (ARTC 2015). The facility is mainly oriented towards the port market, though Aurizon (Australia's largest rail freight operator) also uses Yennora as its Sydney inter-state terminal. Rail services to the port are restricted to outside of the morning and afternoon peak passenger periods. This terminal was originally developed as the central wool warehouse facility for NSW, but has been

gradually redeveloped as an integrated multi-user intermodal terminal/ warehouse facility and is owned by Stockland.

5.6.6 Villawood Terminal (Leightonfield)

Villawood (for the purposes of rail operations commonly known as Leightonfield) — operational since 2004 and situated about 26 km from Port Botany — is owned by Toll and is used for steel distribution. It also operated as an intermodal terminal for export containers for a number of years up to 2012/13. In addition to a transshipment function the terminal offers services of storage (open and covered), maintenance of containers, packing/unpacking of containers and freight forwarding. The terminal connects to the Southern Sydney Freight Line (SSFL) and has two main rail sidings, currently 300 m in length (ARTC 2015). Toll and DP World announced a 50/50 joint venture to redevelop Villawood and operate it is an import/export terminal for up to 185,000 TEU commencing in 2017 (ARTC 2015). As of June 2018, investigations into determining a suitable corridor are taking place to extend the Southern Sydney Freight Line from Leightonfield to the planned Outer Sydney Orbital freight rail corridor near Luddenham (www.transport.nsw.gov.au).

5.6.7 Enfield Intermodal Logistics Centre

Sydney Ports Corporation has developed an Intermodal Logistics Center at its 60-hectare marshalling site at Enfield with the purpose to relieve the congested roads by moving more containers by rail to/from Port Botany. Plans for Enfield started with planning approval in 1997 (Roso 2008; Sydney Ports Corporation 2008) and the completion of a statutory environmental assessment (Sinclair Knight Merz 2005). In September 2007, the NSW Minister of Planning issued approval under Part 3A of the Environmental Planning and Assessment Act 1979 for the construction, operations and associated works pertaining to the Enfield Intermodal Logistics Centre (ILC) — located on the site of the former Enfield Railway Marshalling Yards. Following community outrage, Strathfield Council pursued legal advice to challenge the State Government's approval of the development. At the Council meeting on 5 February 2008, after receiving advice from two barristers that it

was unlikely to succeed with the legal action, the Council decided to not proceed.

The terminal was planned for 500,000 TEU per year but an independent review recommended that it was too large for the site and suggested a total of 300,000 TEU per annum. The site delivers an integrated logistics centre with an intermodal facility at the core. The development consists of: an intermodal terminal in a 13 hectare-area, where a total of 300,000 TEU can be moved into and out of the site; five warehouses close to 52,500 m^2 where around one third of the import containers would be unpacked for delivery and one sixth of the containers packed for export; two road access points linking to Roberts Road and the Hume Highway through industrial areas; empty container storage areas; and on-site traffic management and queueing. The terminal has a warehouse for the packing and unpacking of containers and short-term storage for unpacked cargo, as well as an empty container storage facility depot for later packing or transfer by rail. In December 2015, rail-based transport company Aurizon entered into a Heads of Agreement with NSW Ports to take on the role as the Intermodal Terminal Operator for the Enfield ILC.

The existing freight line between Port Botany and Enfield/Chullora is a dedicated freight rail line. It operates as a single line in its own corridor from Botany Yard to Cooks River, east of the Princes Highway. From Cooks River to Marrickville the line is duplicated. From Marrickville to west of Campsie Station, the freight rail line is duplicated and runs in a shared corridor (separate lines) with passenger trains (Bankstown Line), passing through Dulwich Hill, Hurlstone Park, Canterbury and Campsie. It departs from the shared corridor west of the Loch Street Bridge and proceeds to Enfield and Chullora.

5.7 Moorebank Intermodal Terminal — Detailed Case Study of Dry Port

The Australian and NSW Governments identified the Moorebank precinct as a key strategic location to increase intermodal capacity by an additional two million TEU (NSW Government 2013, p. 122). The Moorebank terminal was first proposed in 2003 while the South Sydney Freight Line, completed in 2013, was first conceived in 1985.

The implication is that land-use and transport planning, which have long time horizons, requires Governments to be made aware of the long-term consequences for freight of their land-use planning decisions (ARTC 2015). The precinct is owned by the Australian Government (158 hectares) and by the Sydney Intermodal Terminal Alliance (SIMTA) who own 83 hectares.

The Moorebank Intermodal Terminal (MIT) is a 241-hectare intermodal freight precinct in the south-western Sydney suburb of Moorebank consisting of an import-export (IMEX) rail terminal, inter-state terminal and up to 190 hectares of onsite warehousing. The Australian Government first announced its plan to relocate the School of Military Engineering to enable the construction of the terminal on its freehold land in September 2004. A private-sector joint venture — SIMTA — was formed in 2007 to develop an IMEX-only terminal and onsite warehousing at Moorebank. SIMTA had planned to build this on its freehold land that was purchased from the Australian Government in 2003. The SIMTA site is situated directly across Moorebank Avenue from the School of Military Engineering land. The original sale was on a leaseback arrangement, where the Australian Department of Defence signed a ten-year lease (with two five-year extensions at Defence's sole discretion) for the Defence National Storage and Distribution Centre's (DNSDC) operations to remain on the site.

Following the Australian Government's consideration of various studies that it had commissioned, the project's implementation commenced in April 2012. The Moorebank Intermodal Company (MIC) is a Government Business Enterprise (GBE). It was established in December 2012 and assumed full responsibility from the Department of Finance and Deregulation for the delivery of the project. Development consent was required under both Commonwealth and State legislation: The Commonwealth Environment Protection and Biodiversity Conservation Act 1999; and the NSW Environmental Planning and Assessment Act 1979. Parsons Brinkerhoff (2014) prepared the Moorebank Intermodal Terminal Environmental Impact Statement under NSW State Government regulations that went on public exhibition.

On 3 June 2016, the NSW Planning Assessment Commission approved MIC's Stage 1 "State significant development" Concept Approval for an intermodal terminal on the MIC owned land at Moorebank. To give an

idea of the scale of this project, if superimposed over Sydney's CBD it would stretch from Circular Quay (in the north) to Chinatown (in the south), and from Darling Harbour (in the west) to William Street (in the east). During operations, MIC's main role will be to monitor SIMTA's compliance with its open access obligations requiring IMEX and inter-state terminals to be operated on a non-discriminatory basis. Any transport operator providing freight transport services may gain access to the terminal.

Given the Commonwealth of Australia's agenda of improving the nation's economic efficiency of national ports, KPMG were commissioned by the Australian Department of Finance and Deregulation to prepare a Detailed Business Case that contains advice, analysis and recommendations for consideration by the Commonwealth of Australia in its deliberations on a proposed intermodal terminal at Moorebank (KPMG, Deloitte and Parsons Brinkerhoff 2012). A governance framework was selected to enable the Moorebank Intermodal Terminal to be delivered by an entity with 'an appropriate commercial focus while maintaining effective Government oversight'.

A large component of MIC's first year was comprised of setting up its operations: engaging a range of key advisory firms to support a competitive procurement process to find a private sector delivery partner; and undertaking market interactions. Following an expression of interest (EoI) process in early 2014, SIMTA was selected by MIC as the preferred private-sector partner (from a total of five respondents) to be responsible for the delivery of the precinct. The two entities entered into a formal direct negotiation process in May 2014, achieving financial close on 24 January 2017. The project is now in its delivery phase.

During 2017, the National Audit Office of Australia assessed whether the contractual arrangements that were put in place for the delivery of the Moorebank Intermodal Terminal would provide value for money and achieve the Australian Government's policy objectives for the project (ANAO 2017). The report found that value for money progressively eroded during the negotiation of the contractual arrangements that took place over thirty-two months. Negotiating directly with one respondent, rather than the original plan of maintaining competitive tension, gave rise to a number of risks. These risks were identified, and mitigation strategies were formulated but never implemented.

Importantly for logistics operations, the contracts provided no assurance that non-discriminatory open access is likely to be available within all aspects of the intermodal precinct. The contractual framework does not apply to all elements of terminal operations. It only partially applies to the rail shuttle service between Port Botany and MIT and internal transfers within the terminal precinct but does not apply to warehouse operations. Key detailed documents that are required for implementation of effective open access arrangements are under development.

The deal is complicated. The Commonwealth funds about AUD 370 million of the development, and, importantly, the rail connection between the terminal and the Southern Sydney Freight Line (Fullerton 2015). Sydney Intermodal Terminal Alliance (SIMTA) — a consortium of Australia's import/export logistics company Qube Holdings and Australia's largest rail freight operator Aurizon Holdings — delivers most of the capital (approximately AUD 1.5 billion over the first ten years), including the terminal infrastructure and warehousing, and contributes eighty-three hectares of land to the development. Qube's investment is around AUD 250 million over the first five years. Also, Qube will be working with other partners for the development of the warehousing precinct — about an AUD 800 development probably over a five-year horizon from now.

Initially, the 241-hectare site will handle 250,000 import-export (IMEX) containers a year from about 2018/9, and ultimately up to 1.05 million IMEX containers a year, and up to 500,000 inter-state containers a year. There will be up to 850,000 m^2 of warehouses where containers can be unpacked before delivery to their final destination. Also, there is the possible future relocation of Moorebank Avenue external to the precinct (subject to future planning approval) that will remain open for public use. Substantial biodiversity offsets protected from development, including vegetation on the eastern bank of the Georges River, will be enhanced and preserved to comply with Commonwealth and State environmental planning legislation.

According to ARTC (2015), the following assumptions have been made concerning future IMEX volumes: Port Botany IMEX shuttle services to and from Moorebank are expected initially to have a 250,000 TEU capacity, and ultimately to have a capacity of 1.05 million containers

(twenty foot equivalents or TEU's) per year in IMEX freight by 2028. Moorebank Intermodal, servicing the inter-state market, is predicted to start-up in 2020 with steadily increasing volumes and an ultimate capacity of 500,000 inter-state containers per year by 2028.

The project proponents claim ambitious goals: taking 3,000 trucks off the road; removing 40,000 tonnes of carbon a year from the air; and reducing the cost of importing and exporting by 20 to 25% (Fullerton 2015). The New South Wales Government fully recognises the impacts such a terminal will have on the local road network and obtained money from the Federal Government under its Nation Building 2 program to undertake transport modelling and economic analyses to determine the optimal road upgrade package to meet the needs of the Moorebank facility. The impact on road investment, plus other issues, has been the essence of community objections to this proposal, including a gross underestimation of traffic generation (van den Bos n.d.). The implications of this underestimation of traffic are that the externalities associated with the terminals are also underestimated: road traffic accidents; vehicle emissions; and noise pollution. Furthermore, the report argues that the intermodal terminals will attract the co-location of low-density industries and the Liverpool Local Government will find it difficult to meet its employment targets under the State Metropolitan Planning Strategy.

The Moorebank Intermodal Terminal — Traffic and Transport Impact Assessment (prepared by Parsons Brinkerhoff) analysed New South Wales Roads and Maritime Services' crash data for the years 2008–2013 for the section of Moorebank Avenue between the East Hills Railway Line and south of the intersection with the M5, and for the section of the M5 between the Hume Highway and Heathcote Road intersections (Moorebank Intermodal Company 2015, pp. 22–23). The project proponents noted both roads were accident "black spots". The project proponents proposed treatments and their potential individual impact on the type of accidents that occur (Moorebank Intermodal Company 2015, Table 9.39). Further investigations by the NSW Roads and Maritime Services have led to a recommended package of works of about AUD 500 million.

The Liverpool Community Independent Team argued that there are more appropriate, more efficient and more economical solutions

for the location of new intermodal terminals. One solution is to move the problem elsewhere — to Eastern Creek. The second solution is to move the problem out of metropolitan Sydney entirely — south to Port Kembla — exploiting a rail corridor between Maldon and Dombarton. While the project has long been on the planning books, it is seen by all governments as uneconomical. The Moorebank Intermodal Terminal is another example of port-generated conflicts — specifically, the lack of the local community's tolerance of governments delivering large infrastructure projects "in their backyards".

5.8 Funding and Financing Port, Terminals and Transport Access

Government-owned ports typically obtain capital and operating costs from government annual budget appropriations. In the case of ports in Sydney (Port Jackson and Port Botany) the New South Wales Government Maritime Services Board was a statutory authority responsible directly to the minister — effectively operating as a "silo" within the governance arrangements of the state. In such arrangements there was little incentive for financial discipline, and, in the absence of economic, social and environmental assessments, it is impossible to estimate the costs of constructing Port Botany that includes its external costs. Nowadays, completely different processes are in place, with the New South Wales Government formulating State strategic and economic plans. Individual infrastructure projects must undergo detailed scrutiny through submission of their strategic and final business cases to Cabinet for whole of government approval (or rejection), before making their way into the capital works program of the respective government line agencies. Sydney Ports Corporation was formed to introduce more commercial practices.

The New South Wales Government aspires to make Port Botany the largest container port in Australia. Recently, Port Botany underwent a major expansion of its container port facilities to cope with the growing volumes of trade — one of the largest port projects ever to be undertaken in Australia in the last thirty years. It entailed the design, construction, procurement, and the eventual awarding to Hutchison Port Holdings (HPH) of the 3rd Stevedore contract (NSW Ports 2015). The Government

called for the operation of long-term leases (ninety-nine years) for two of Australia's largest ports. Port Kembla is Australia's largest vehicle import hub and the largest grain-handling terminal in New South Wales and Port Botany is the country's second largest container port. The winning consortium — IFM Investors, AustralianSuper, QSuper and Abu Dhabi Investment Authority — made an upfront payment of AUD 5.07 billion–AUD 4.31 billion for Port Botany and AUD 760 million for Port Kembla (Infrastructure Australia 2014, p. 22). In addition, the consortium pays an annual AUD 5 million to the State Government under the lease agreement.

The construction costs associated with this asset amount to approximately AUD 1.6 billion in 2016 prices as adjusted by the Reserve Bank of Australia inflation calculator. The Foreshore Road in Botany was purpose built for truck access to and from the ports, but its construction costs would require searching records of the former New South Wales Department of Main Roads. The cost of recent upgrades to roads in the vicinity of the port and airport are about AUD 700 million. Of course, it is incorrect to allocate the hinterland road costs exclusively to the port and its movement of freight because of the close location of a major domestic and international airport as well of other road users. The Botany Goods line served the former coal-fired power station at Bunnerong but recent rail upgrades can be costed at AUD 75 million. The biggest unknown in these estimates of capital costs is the intermodal terminals in metropolitan Sydney. This sum must be substantial. The latest terminal under construction at Moorebank is a Public Private Partnership involving some AUD 1.9 billion of Government and private capital.

Table 5.4 presents a partial analysis of the capital costs of Port Botany, some of the distributed dry port capital costs and hinterland transport construction costs only where data are readily available. Further research is needed to account for all of port associated infrastructure in the hinterland and to allocate the proportion attributable to port vehicles on the road. However, the table gives an impression of the relative breakdown of the very long-term capital costs of port development and enabling infrastructure in the hinterland. Clearly, the capital costs in the logistics chain extend well beyond the costs of building a container port, as do the externality costs of the emissions of ships in port (Styhre et al. 2017), container truck emissions, noise and loss of residential amenity.

Table 5.4 Approximate construction costs of Port Botany and enabling infrastructure (Australian Dollars in 2016 prices)

Infrastructure	**Construction Cost (AUD millions)**
Port Botany	621
Terminal 3 Container Terminal Dredging	800
Terminal 3 landside Wharf	200*
Enfield Intermodal Terminal and Port Botany yards	483
Cooks River — development application for grain silo	10
Moorebank Inter-Modal Terminal**	1870
Botany Goods Rail Line Phase 3	75
Airport/Port Road Upgrades	700

* Private sector confidential — estimate only
** Private Sector plus Commonwealth Government
(Table by the authors, data from various government websites)

5.9 Conclusions

Issues surrounding suburban intermodal terminals, or dry ports, are a sub-set of the wider economic, social and environmental problems of the interactions of seaports with their hinterland. This is clearly demonstrated through historical analysis of port development in Sydney, as noted by Butlin (1976, p. 8, italics in the original):

> *most of the problems that have arisen with respect to Port Botany derive from the statutory obstacles to the integration of the Port with its hinterland and with the whole of metropolitan land-use planning.*

Historically, ports have been developed with little thought given to their impacts on the hinterland. Stevedores have seen their prime task of the contractual arrangements with shipping companies to load and unload containers in the port terminal (IPART 2008). The problems of not taking a holistic approach to planning ports as part of an urban system are many.

The first issue of relevance to Indonesian ports considering expansion is therefore the role of regulators and the statutory planning processes in place and whether reform is desirable. Port expansion *in situ* can

only occur if port activities encroach into surrounding residential, commercial and industrial areas, or if land is reclaimed from the sea. Both options bring into play the regulatory powers of national, state and local governments. At the forefront of any battle to develop port facilities will be the local government in which the port is located. In the case of Port Botany we have shown how local government has imposed land-use zoning policies to facilitate port (and airport) related activities.

The national governments sometimes may add fuel to the fire of such conflicts in port development. On what sounds like an echo from the past, the Australian government recently released a Smart Cities Plan and noted "urban development pressures around airports, seaports and intermodal facilities need to be carefully managed to prevent these important economic hubs and corridors from being constrained and to reduce their impacts on surrounding communities" (Commonwealth of Australia 2016, p. 16). Nevertheless, given the Federal Government's policy of making gateway ports (seaports and airports) the engines of economic productivity, it seems that port-hinterland research funding is essential to support the aspirations of this Smart Cities Plan.

A related issue is the role of governments at the national and state (provincial) levels in port planning, development and operations. When addressing the general logistics or supply-chain management problem, what is the appropriate role of governments and other stakeholders in the planning of seaports and dry ports in any urban system? This is essentially a question of political economy, and our case study of Sydney can only provide some guidance. The means of regulating urban system growth, mechanisms of resolving environmental conflicts and the relative power of political parties and different stakeholders and the community to influence planning and development decisions remain as research topics of relevance today when studying maritime ports. This clearly represents an important topic of investigation for Indonesian ports.

Another issue of relevance to Indonesia is the queueing of trucks on streets surrounding the ports and the general problem of road traffic congestion in the ports' hinterlands. The Sydney case study, with its stevedore vehicle booking system (VBS), indicates the importance of information technology in reducing congestion around ports. The key road access to and from Port Botany is the Foreshore Drive linking

the Southern Cross Drive that tunnels under the airport's two parallel runways before joining the M5 toll road to the west of the port, but these are capacity constrained. Under construction as of 2018 is the WestConnex Motorway project linking the M5 and M4 tollroads that will also provide better road access between Port Botany and its metropolitan hinterland. From Marrickville to the wharves at Port Botany is the Botany Goods line that connects to the shared passenger and freight rail network of metropolitan Sydney, including the route to the Enfield inter-modal freight terminals. As of 2018, there is construction work to upgrade this railway. However, the evidence is that governments throughout the world struggle with effective policies to encourage transport companies to ship containers by rail instead of roads.

Finally, a well-functioning network of inland terminals is crucial to achieve the goal of shifting freight from road to rail. In the case of Port Botany, there has been clear cooperation between national and state governments on providing suitable land for the terminals. Port Botany, and its close inland intermodal terminals, is a very distinctive port globally because there are very few other ports with such a well-developed network of close, inland intermodal terminals in their metropolitan hinterlands. The most recent terminal project at Moorebank was delivered through a public-private sector partnership involving a New South Wales State Government Enterprise and SIMTA, but as noted this has not been without controversy. Moorebank intermodal logistics terminal was first conceived in early 2000, demonstrating the problematic aspect of long timeframes for development of significant infrastructure to support the transport of containers to and from ports. For Indonesian researchers, the literature on the success factors of locating dry ports cited in this chapter are worthy of careful study.

Finally, it is worth speculating on the value of research into ports and their hinterlands both for Australian and Indonesian researchers. There is little appetite to fund evidence-based policy analysis in the Australian transport sector. As one anonymous, senior government transport bureaucrat put it: "there are no votes in conducting such studies: Ministers love to cut the ribbon on an infrastructure project and not to worry about on-going maintenance nor potential problems." Nevertheless, given the Federal Government's policy of making gateway ports (seaports and airports) the "engines of economic productivity" it

seems that port-hinterland research funding is needed to learn from the outcomes of past policies and to determine those transport policy options that will not burden economic, social and environment costs on future generations. Independent analyses are needed in the era of Public Private Partnerships for inter-modal terminals, as demonstrated by the controversy surrounding Moorebank Intermodal Terminal.

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