FreightSmart

Consultancy Report Prepared for

COUNCIL OF AUSTRALIAN GOVERNMENTS

REVIEW OF URBAN CONGESTION TRENDS, IMPACTS AND SOLUTIONS

by

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October 2006

This document does not necessarily reflect the views of the Commonwealth, State or Territory governments, and has been prepared by IMIS, John G Edhouse & Associates, Paul Garth and Masson Wilson Twiney to inform the Urban Congestion Review, which was commissioned by the Council of Australian Governments.

Final Report
to
The Standing Committee on Transport
Urban Congestion Management Working Group

FreightSmart Study – Parts A and B

from

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IMIS devoted normal professional efforts to the preparation of the Report, and its findings represent its reasonable judgments within the time and budget context of its commission and utilising the information available to it at the time.

EXECUTIVE SUMMARY

E.1 Overview of Project

Using modelled case studies, the Project has assessed the implications for congested urban road networks of some changed operating practices which could be adopted by certain businesses reliant on road freight transport in Sydney, Melbourne and Brisbane. The case study businesses participate in one of five supply chains whose various functions comprise the transport of shipping containers, and the distribution of food or liquor.

The analysis has focused on behavioural changes at the business level which lie outside the traditional scope of transport system development and management programs that are the responsibility of State governments. The Project has identified changes of this type that may be able to made to: the operating hours of supply chain nodes; the configuration of supply chain nodes; fleet arrangements; and freight vehicle access to strategic transport routes. Given certain parallels with changed personal or household passenger transport decisions that are commonly termed 'TravelSmart', these supply chain changes have been given the working description of 'FreightSmart' actions.

Based on process mapping and related analysis of the case study supply chains, including participating businesses' detailed operations, the Project estimates annual industry and wider community benefits valued at approximately $15 million / year from the implementation of FreightSmart actions across all businesses active in the empty shipping container and major food / liquor supply chains in the three cities. These benefits include generalised road user savings resulting from the removal of freight trips from the most congested periods of operation of the network. The supply chain changes will deliver net benefits to the set of participating businesses, and thus increase the efficiency of the urban supply chains and have high cost-benefit ratios.

Initial modelling shows that the annual value of benefits could be increased to $20 million by the additional involvement of businesses in the building materials supply chain in the three cities. Assessment of the benefits of FreightSmart actions, including the possibility of maximising these by actions being undertaken across the widest possible variety of urban supply chains, would be subject to the implementation of case studies as real-time demonstration projects (and subsequent detailed modelling). The Project has led to the recommendation that these demonstration projects be initiated.

E.2 Background

In April 2006 the SCOT Urban Congestion Management Working Group (UCMWG) appointed Integrated Management Information Systems Pty Ltd (IMIS) to undertake the first two parts of a FreightSmart Supply Chain Improvement and Congestion Management Project (the ***Project***). The primary focus of the Project was on improving the efficiency and alignment of major urban supply chains involving the transport of freight by road in Sydney, Melbourne and Brisbane (termed '***re-alignment***'), and its objectives were to:

- consolidate and draw on existing data, procedures and findings relating to urban supply chain alignment;
- identify case studies to demonstrate possible re-alignments;

- apply mapping and evaluation procedures to provide more accurate estimates of benefits and costs from re-alignment, particularly relating to congestion management and freight efficiency benefits; and
- identify and recommend directions for an on-going FreightSmart Program across Australian cities, and the role of government agencies in such a program.

E.3 Project Structure and Status

The Project is structured in four primary parts, these being:

- Part A – Identify supply chain case studies;
- Part B – Scope case studies;
- Part C – Implement case studies; and
- Part D – Evaluate cases and recommend a FreightSmart Program.

This report documents the tasks and findings for Parts A and B of the Project. Part C and, subsequently, Part D would be initiated following review of these findings.

E.4 Preliminary Assessment and Re-alignment Case Studies

The first stage of the Project included: accessing existing data and the results of previous analyses relating to current shipping container supply chain operations; and conducting a preliminary assessment of the potential for re-alignment of this and other case study supply chains, and the likely impacts, costs and benefits, with a particular focus on urban congestion reduction.

This preliminary assessment was complemented by the formation of a Reference Group and consultations with group members and management in several supply chain businesses in Sydney, Melbourne and Brisbane. These consultations indicated that there are a number of constraints which are currently causing inefficiencies in the alignment of urban supply chains. The primary constraints, and their impacts on freight trips and road congestion are as follows:

- The limited, and differing, hours of operation of supply nodes (eg., container parks, retail outlets, distribution centres), causing truck trips to be made in Am-peak and Pm-peak periods;
- Parking and traffic management restrictions adjacent to freight drop locations, necessitating smaller trucks for deliveries and multiple trips later in the day to service freight demands;
- Business period truck parking restrictions, causing some truck trips to shift to peak periods;
- Environmental protection measures (eg., night time restrictions on freight vehicle operation), limiting hours for deliveries;
- Freight vehicle configurations in existing fleets, limiting efficient freight movement and causing increased trips;
- Planning controls (eg., restrictions on locations of freight facilities), necessitating smaller trucks for deliveries and multiple trips later in the day to service freight demands;
- Physical development constraints (eg., limits on the size of truck docks at retail outlets), necessitating additional truck travel to move products through the manufacturing-warehouse-consumer chain.

Consultations also indicated that these constraints are not limited to port-related chains and that businesses engaged in a number of urban supply chains are actively seeking to re-align their activities, to address one or more of the above constraints and gain increased efficiencies. It was therefore possible to identify several businesses prepared to participate in re-alignment case studies, across sections of different urban supply chains. The case studies able to be conducted within the time period and resources for Parts A and B of this Project related to:

- the extension of container park hours into evening periods (Sydney, Melbourne – Appendices A, D and G);
- advancing the start of daily transport operations for liquor distribution (Melbourne – Appendix E);
- advancing or restructuring the daily transport operations for cold foods distribution (Brisbane – Appendix F); and
- shifting distribution centre (DC) receival hours for shipping containers to pre-peak or night time periods (Melbourne – Appendix H).

E.5 Mapping Process and Evaluation Framework

Industry consultation and preliminary assessments indicated that re-alignments would have a range of operational, financial, economic, social and environmental impacts and that these had to be addressed in order to identify and achieve sustainable outcomes from re-alignment. Process mapping procedures were applied in each case study to: identify the constraints on current freight-related operations; identify the actions needed to remove these constraints, and the resultant efficiency gains for freight-related operations; and identify and estimate the likely changes in costs and benefits for participating businesses, as inputs to the evaluation of re-alignment actions.

A framework was developed for the evaluation and implementation of re-alignment actions which:

- aids identification of the alignment problem and re-alignment actions;
- estimates the impacts, costs and benefits for all affected parties;
- estimates the reductions in urban congestion and emissions and the likely wider urban system and economic impacts;
- aids the development of 'benefit transfer' mechanisms, to share the net benefits among parties along the supply chain; and
- aids consideration of trade-offs between objectives (eg., congestion reduction and noise reduction).

E.6 Primary Findings

The primary findings from the preliminary assessment and the five FreightSmart case studies are as follows.

- There are constraints at several nodes along the shipping container supply chain (ie., container park, distribution centre, importer depot) that are causing a significant percentage of urban container movements to be made in Am-peak or Pm-peak periods (Appendices A, D, G and H).
- There are also constraints in several other urban supply chains, in particular the food distribution chain, that are causing significant percentages of truck trips to be made in the Am-peak and Pm-peak periods (Appendices E and F).
- It is feasible and desirable that an 'integrated' strategy for re-alignment of the shipping container and food distribution supply chains be developed and implemented, involving the alignment of activities at several nodes along the respective chains.
- Extended across all relevant supply chains in the three subject cities, integrated re-alignment strategies are likely to have the following impacts and benefits (Appendix I):
    - Shift shipping container and food transport trips from peak periods and, possibly, business periods to early morning or night time periods;
    - Reduce the use of arterial / collector road networks during peak periods, by the order of 500 to 1,000 veh-hrs/work day for cars and 200 veh-hrs/work day for trucks;
    - Reduce vehicle fuel consumption and emissions by the order of one per cent;
    - Reduce operating costs and increase fleet productivity for transport operators;

  - Induce aggregated direct benefits for road users, and flow-on benefits for freight-related and other business sectors, of the order of $15 million / year;
  - Incur some increased noise in night time periods, requiring consideration of congestion-noise trade-offs;
  - Require increased night-time operation of personnel (eg., drivers, freight receival personnel), with possible social impacts; and
  - Provide a high overall economic return, given the relatively low cost of effecting necessary changes (eg., as market adjustment incentives).
- It is likely that forms of benefit 'transfer' or 'market adjustment' processes will be required, to ensure that constraints are reduced, ramp-up to a re-aligned supply chain structure occurs, and sustainable outcomes are reached in the near future.

Re-alignment of Other Urban Supply Chains

Recent freight movement research and industry consultations have indicated that there is significant freight movement for other industry sectors which impact on Am-peak traffic, in particular the movement of building materials. Re-alignment in the building materials chain could be expected to reduce trips contributing to peak period congestion and generate other benefits, and warrants further consideration as part of a FreightSmart Program.

E.7 Recommended FreightSmart Directions

There are a number of actions which are required to facilitate urban supply chain re-alignment and ensure its integration with other urban congestion reduction and environmental management actions. The primary, recommended actions are as follows.

E.7.1 Parts B and C of the Project

The ***recommended actions*** for Parts C and D of the Project are as follows.

- ***Implementation of each of the five case studies (Appendices D to H)***. It is desirable that this commence during the Oct-Nov 2006 period, to ensure that: business support for initiatives is maintained; that impacts are assessed for the non-Christmas/New Year period; and that further information can be generated to inform government decisions relating to urban congestion management programs.
- ***Other potential case studies***. Other case studies were identified in Brisbane and Melbourne during Part B, relating to the shipping container and food supply chains. These would complement the five case studies conducted to date. They should be conducted during Part C, with a view to implementation in an ongoing FreightSmart Program, if it proceeds.
- ***Industry information and education programs***. Information obtained during the case studies can be adapted into forms suitable for increasing industry awareness of the benefits of supply chain re-alignment, and actions which individual businesses can take to achieve these. This could include information brochures and industry workshops.
- ***Noise – congestion trade-offs***. Data obtained during the Project can be used to highlight the potential trade-off between increased night-time noise and daytime congestion reduction which might be a necessary consequence of FreightSmart re-alignment actions.

E.7.2 Possible On-going FreightSmart Program

Project findings indicate that re-alignment actions in several sections of the urban supply chains studied can reduce traffic generation contributing to urban congestion and emissions, and increase freight efficiency, with minimal government or other stakeholder investment. Thus, these actions would be cost-effective and would offer commercially sustainable benefits to businesses operating these chains. To facilitate the re-alignment actions occurring and their effective integration with other short and long run road congestion management and freight efficiency initiatives, it is ***recommended that*** the following actions be undertaken as a part of an on-going FreightSmart Program:

- ***Continued re-alignment case studies***. These would focus on sections of the supply chains not covered by the cases in Part B (eg., shipping container movements to and through distribution centres, manufacturing-distribution operations in the food and building materials sectors).
- ***Extended case studies***. These would focus on studies which address the integration of re-alignment actions with:
    - traffic management actions, to ensure optimisation of personal and freight transport operations;
    - related initiatives by Reference Group members (eg. the use of the Intelligent Access Program to enforce changed freight transport operating hours available to participating operators); and
    - strategic land use and other planning decisions by businesses and agencies, in particular the location of freight-related activities over time.

1. INTRODUCTION

In April 2006 the SCOT Urban Congestion Management Working Group (UCMWG) appointed IMIS Integrated Management Information Systems Pty Ltd (IMIS) to undertake the FreightSmart Supply Chain Improvement and Congestion Management Project (the ***Project***).

The primary focus of the Project was on identifying changed operational behaviours (and other, longer-term decisions) by businesses and government agencies which could improve the efficiency and alignment of major urban supply chains involving the transport of freight by road. (These possible supply chain improvements will be termed '***re-alignment***' in this document.) On the basis of previous study it was anticipated that re-alignment actions could take the form of any combination of the following initiatives as appropriate to the supply chain in question:

- Re-scheduling the receipt and/or dispatch of freight, including empty containers, to facilitate off-peak operation of freight vehicles;
- Re-structuring or extending freight receipt, dispatch, storage and/or handling arrangements (including physical facilities and/or operating hours), to achieve higher productivity and efficiency;
- Re-scheduling or re-configuring freight vehicle fleets, to reduce peak or total hours; and
- Modifying freight transport operating hour restrictions in relevant restricted corridors.

The intention of the UCMWG was that any significant re-alignment opportunities for the studied supply chains could be referenced among the congestion management measures recommended for consideration by the Australian Transport Council and, in due course, COAG at the conclusion of the Urban Congestion Review initiated by first ministers in February 2006.

To facilitate the cost-effective conduct of the Project IMIS's resources were complemented by personnel from John G Edhouse and Associates (JEA) and Masson Wilson Twiney (MWT) and specialist advice was provided by Mr Paul Garth and Mr Tim Squires, Vic-President of the Qld Trucking Association (Chairman of the QTA Waterfront Carriers). The total resources from the above businesses will be referred to as the ***IMIS Team***.

This document contains a draft Final report for Parts A and B of the Project.

2. PROJECT OBJECTIVES, SCOPE AND STATUS

As indicated in Section 1 of the Project brief, several recent studies in Australia have indicated that there are opportunities for re-alignment of major urban, road-based supply chains and the achievement of benefits for:

- individual businesses, from improved operations and reduced transport costs; and
- the wider transport system, and urban communities, due to reduced congestion in peak periods.

The scope and detail of these recent studies were sufficient to:

- identify supply chains in which re-alignment is likely to be feasible;
- identify businesses which might participate in cases to assess re-alignment actions;
- indicate that industry agencies (eg., transport, logistics) are willing to endorse projects which will increase freight system efficiency; and

- develop strategic transport data and models which aid estimation of the likely impacts, costs and benefits of supply chain re-alignment for transport and urban systems.

However, the studies did not enable a detailed assessment of the: potential for change in particular sections of the urban supply chains; actions required to achieve sustainable changes; and, associated benefits and costs within businesses, industry sectors and the wider urban and economic systems. To guide the development and implementation of a FreightSmart Program it is therefore necessary that more detailed assessments of the major urban supply chains be undertaken to:

- identify the sections of supply chains and the businesses in which re-alignment can be achieved;
- identify and quantify the impacts, benefits and costs from re-alignment for individual businesses and the wider urban and economic systems; and
- define an ongoing FreightSmart Program for possible implementation, if the assessments indicate that sustainable re-alignment can be achieved.

2.1 Scope of the Project

Given the above scope of previous studies and the findings from them, the state of data and analysis procedures and governments' commitment to support freight efficiency and congestion reduction programs it was essential that this Project:

- consolidate and draw on the data, procedures and findings from previous supply chain re-alignment studies, particularly those in Sydney, Melbourne and Brisbane;
- quickly identify potential case studies, and arrange business partnering, so that re-alignments can be demonstrated and evaluated in sufficient detail to provide a basis for an on-going FreightSmart Program;
- specify and apply business mapping and evaluation procedures which will advance the evaluations from previous supply chain studies and provide:
  - more accurate estimates of costs and benefits for participating businesses; and
  - strategic estimates of industry, congestion, environmental, social and economic costs with sufficient accuracy to guide consideration of a future Program; and
- identify and recommend directions for an on-going FreightSmart Program for possible implementation in Australian cities, and the related role of various government agencies.

2.2 Project Structure and Status

The Project was structured in four primary parts, these being:

- Part A – Identify supply chain case studies;
- Part B – Scope case studies;
- Part C – Implement case studies; and
- Part D – Evaluate cases and recommend on-going program.

Approval was given for the conduct of Parts A and B and this document contains the report on these two parts.

3. PART A – IDENTIFY SUPPLY CHAIN CASE STUDIES

The primary objective of this part of the Project was to identify a section of a major supply chain in each of Sydney, Melbourne and Brisbane, and businesses operating in these sections, in which:

- re-alignment appeared feasible and likely to lead to tangible, sustainable benefits; and
- businesses were able to commit the resources required to identify, assess and advance re-alignment actions within the timeframe for this Project.

3.1 Establishment of a Reference Group (RG)

Through several freight-related projects in recent years the Team had established strong links with the senior personnel in:

- major industry agencies and businesses associated with urban supply chains in Sydney, Melbourne and Brisbane; and
- State and National government agencies associated with freight transport in the three cities, and in other Australian cities.

It was therefore possible for the Team to identify the agencies appropriate as members of the FreightSmart Program RG, and these are indicated in Figure 3.1.

3.1.1 Ongoing Communications

It was confirmed that the most cost-effective means for continuing communication with the RG during the Project was by phone and email, with the form and frequency of communications being determined by the needs of the particular parts of the Project.

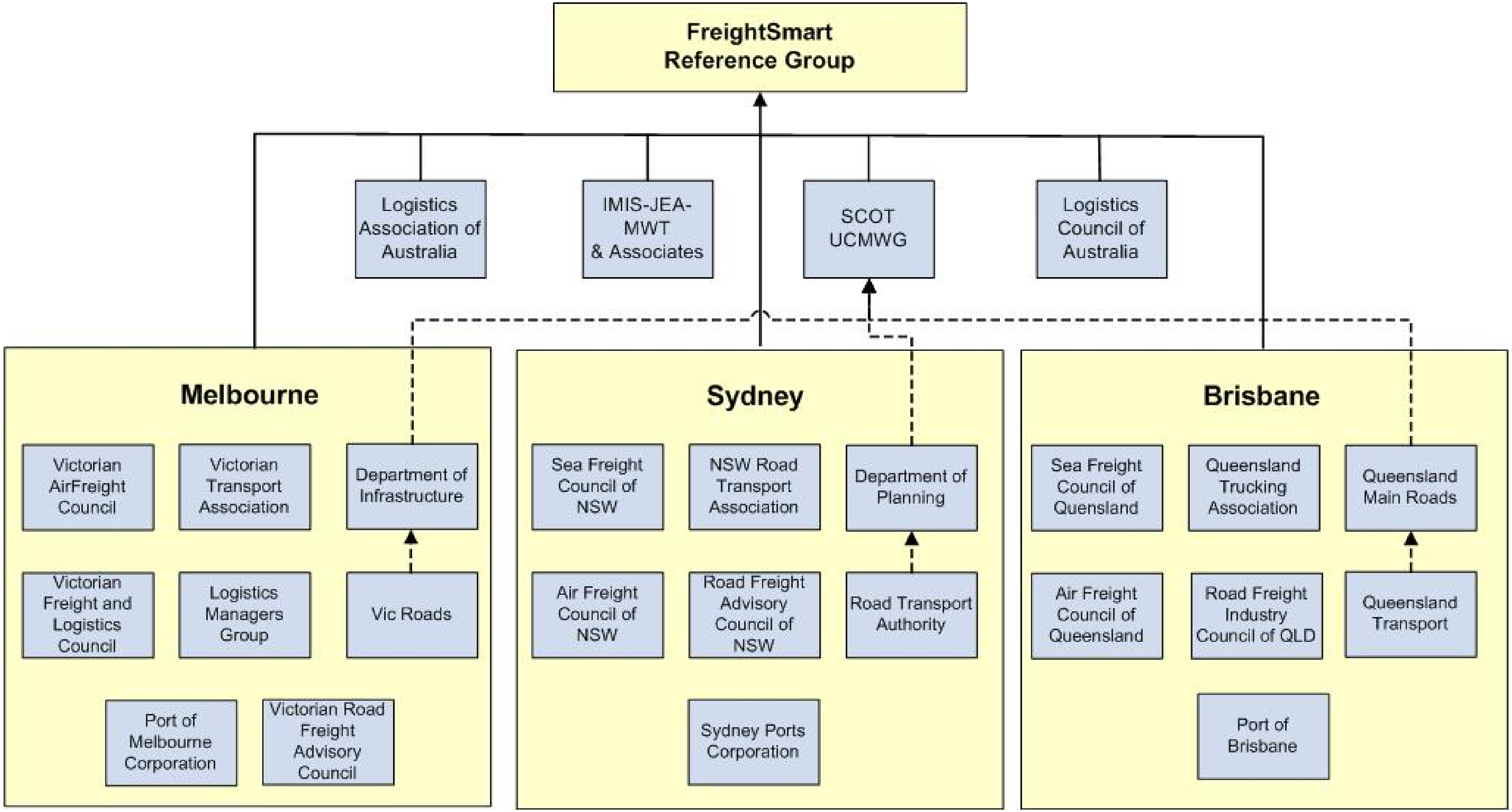

Figure 3.1 Agencies in the FreightSmart Reference Group

3.2 Preliminary Assessment from Existing Data Sources

A review of recent projects, data and documents relating to supply chain and freight operations and management, both in Australia and overseas indicated that data and analyses reported by the Melbourne Business Activity Harmonisation Study (BAHS, 2005) and the Freight Supply Chain – Coordination of Working Hours – Mismatch of Hours Study (Meyrick and Associates, 2005) could be used to provide a more detailed understanding of the potential impacts and benefits of supply chain re-alignment, relevant to Australian cities.

While these studies focused primarily on port-related chains, a preliminary assessment of the information relating to these chains began to provide a more rigorous understanding of the likely impacts of re-alignment and a base for advice to COAG. The findings from these assessments are summarised in the following Sections and in Appendix A.

The review indicated that there were no comparable data relating to non-port-related chains and the case study identification task (Section 3.3) therefore sought cases in non-port-related chains.

3.2.1 Re-alignment of Container Supply Chain Hours - Melbourne

The BAHS (2005) report identified that there are currently major delays in the movement of shipping containers through container parks and other nodes in the container supply chain in Melbourne, and that extension of the operating hours for existing container parks was an important, desirable action to increase the efficiency of container freight transport. Consultations with container transport operators and other relevant parties as a part of the BAHS indicated that:

- this condition is largely due to the current, restricted hours of operation of the parks; and
- the delays in container delivery-recovery are causing significant increases in:
    - freight vehicle operating costs (vehicle and driver);
    - the number of vehicles required to service container movements; and
    - container demurrage charges.

As indicated by Attachment D of the BAHS (2005) report, the previous assessment of changes in container park hours did not include consideration of the possible wider impacts of such changes on travel conditions and congestion across the Melbourne road network. The previous BAHS assessment was therefore extended in Part A of this Project, to consider urban congestion impacts, and resulting analyses and findings are summarised in Appendix A.

Primary Findings

The primary findings from the assessments of container chain re-alignment in the BAHS and this Project were as follows:

- There are constraints at several points in the container supply chain, not just the container parks, which are causing a significant component of container trips to occur during the most congested Am-peak and pm-peak periods.

- Re-alignment of the activities of supply nodes and transport operations in the container chain are likely to induce the following impacts, costs and benefits:
    - Transport operator costs would reduce, due to:
        - reduced delays at the park;
        - reduced truck trips for the set of container movements; and
        - (potentially) reduced fleet size and/or increased vehicle productivity over time.
    - While split-shifts, or other staffing arrangements, might result in no material staffing increase, container park operating costs might increase, if there were a need for additional labour hours.
    - There would be a net benefit to the directly affected parties (ie., transport operator and container park operator).
    - To be commercially sustainable, a 'transfer' of part of the benefits to the container park operator would be necessary, possibly through transport operators paying a premium on night time deliveries of containers.
    - There would be 'flow-on' benefits to the transport system of the order of $4 million / year, through a reduction in traffic volumes adding to road congestion.

3.2.2 Extended Importer Distribution Centre Hours - Sydney

The Meyrick (2005) investigation of the coordination of working hours and related arrangements included several case studies of businesses in NSW, with a particular focus on businesses engaged in import-export operations.

A case study of relevance to this Project related to the transport of containers from Port Botany to an importer.

The current hours of operation of the importer necessitate overnight 'staging' (ie., holding) of the containers at the transport operator depot, incurring handling costs for the operator and a larger number of trips on the road network. This is consistent with the observed transport of imported containers in Melbourne (Section 3.2.1 and Appendix A).

The Meyrick case study included an assessment of likely impacts if the importer hours were extended to enable more direct movements from wharf to importer. It has not been possible to date to access data for this case study, but the results of analyses reported by Meyrick (2005) indicate that extension of the importer operating hours would:

- reduce the need for staging at the transport depot;
- increase productivity for the truck operator by the order of 20%;
- measurably reduce traffic contributing to congestion of the Sydney arterial road network; and
- reduce the total cost per imported TEU (ie., standard container) by the order of $12.

3.3 Identification of FreightSmart Case Studies

As indicated in Section 3.2, the primary focus of previous supply chain re-alignment studies was on the container supply chain, and the Project brief therefore called for this component of the Project also to seek cases which are in other urban supply chains.

Potential case studies were identified through.

- consultations with agencies in the RG, to identify:
    - a ‘target’ list of businesses;
    - appropriate senior management contacts;
- phone and face-face contact with the senior management, to:
    - assess the potential and interest in re-alignment and seek agreement to be a partner; and
    - confirm the feasibility of re-alignment being progressed during the Project.

Case Study Scope, Timing and Resource Requirements

The information gained in the consultations indicated that re-alignment of several sections of urban supply chains would be feasible. The immediate UCMWG requirement was to conduct case studies in each of Brisbane, Sydney and Melbourne during June – Aug 2006 to demonstrate that supply chain changes can be implemented and that sustainable, quantifiable benefits can be realized. To achieve this it was necessary to select cases which:

- could demonstrate quantifiable benefits within the immediate tight timeframe;
- enabled prompt agreement of the relevant parties to participate in and conduct a case study; and
- set the basis for 'roll-out' to a larger pool of participants in an on-going Program.

The cases outlined in Sections 3.3.1 to 3.3.5 were identified and met these immediate and longer term requirements.

3.3.1 Case 1 - Extended Container Park Hours: Melbourne

As indicated in Section 3.2.1, there is a strong potential for re-alignment of shipping container supply chains, particularly in Melbourne and Sydney, and this could be expected to assist a measurable reduction in traffic contributing to peak period congestion on the arterial road network. It was therefore desirable to focus a case study on a component of the container chain in Sydney and/or Melbourne, to confirm or vary the estimates from the preliminary assessments reported in BAHS and in Section 3.2.

Current Operations, Constraints and Possible Case Study

The current operations of the import container chain in Melbourne are depicted in Figure A.1, Appendix A, and described in Appendix A. As indicated, the current transporting of import containers frequently involves:

- double handling and multiple vehicle trips for import container movements; and
- vehicle trips occurring during peak periods, apparently as a consequence of constraints at several points in the supply chain, in particular:
  - operating hours at container parks; and
  - receival windows at Distribution Centres (DC's).

It was therefore desirable to structure a case study to address part or all of the wharf-to-transport operator-to-DC-to-container park supply chain.

Case Study Scope and Resource Requirements

One of the major container parks in Melbourne is operated by Chalmers Transport, with current container park operating hours being 06:00 – 16:00. As indicated in Appendix A, a strategy of extending the park hours into the evening is likely to have significant congestion and freight efficiency benefits. Patrick Transport is a major user of the park and mapping of the container de-hire component of the Patrick operations at the Chalmers park was found to be feasible within Part B of the Project, thereby providing an extension of the preliminary assessment reported in Section 3.2.1 and Appendix A.

Chalmers and Patrick agreed to participate in this Project, and to enable mapping and assessment of a possible extension to container park hours into the evening to handle the de-hiring of import containers.

Mapping of the de-hire component of the import container supply chain was conducted. Through consultations with Chalmers and Patrick it was agreed that the primary tasks and outcomes would be as follows.

- Estimation of current container park costs and the likely changes resulting from extending hours.
- Generation of a profile of container receivals and the broad trip distribution for Patrick and all operators.
- Estimation of the likely shift in the Patrick profile and trip distribution, and the associated costs and benefits for Patrick, under an extended hours strategy.
- Extension of the estimates for Patrick to other transport operators using the Chalmers container park.
- Extension of the estimates for the Chalmers park to the population of de-hire operations in Melbourne.
- Estimation of the likely impact on road congestion for the set of major roads which are involved in the container de-hire operations, providing confirmation or variation of the congestion reduction estimate in Section 3.2.1.

Details of this case study are contained in Appendix D.

3.3.2 Case 2 - Extended Liquor Distribution Hours: Melbourne

Liquor distribution is a daily operation in major urban areas and involves movements between warehouses and a set of clients (ie., liquor retailers). As depicted in Figure 3.2, it often involves a line-haul operation between the warehouse and a distribution area, a series of drops to clients and a return haul to the warehouse.

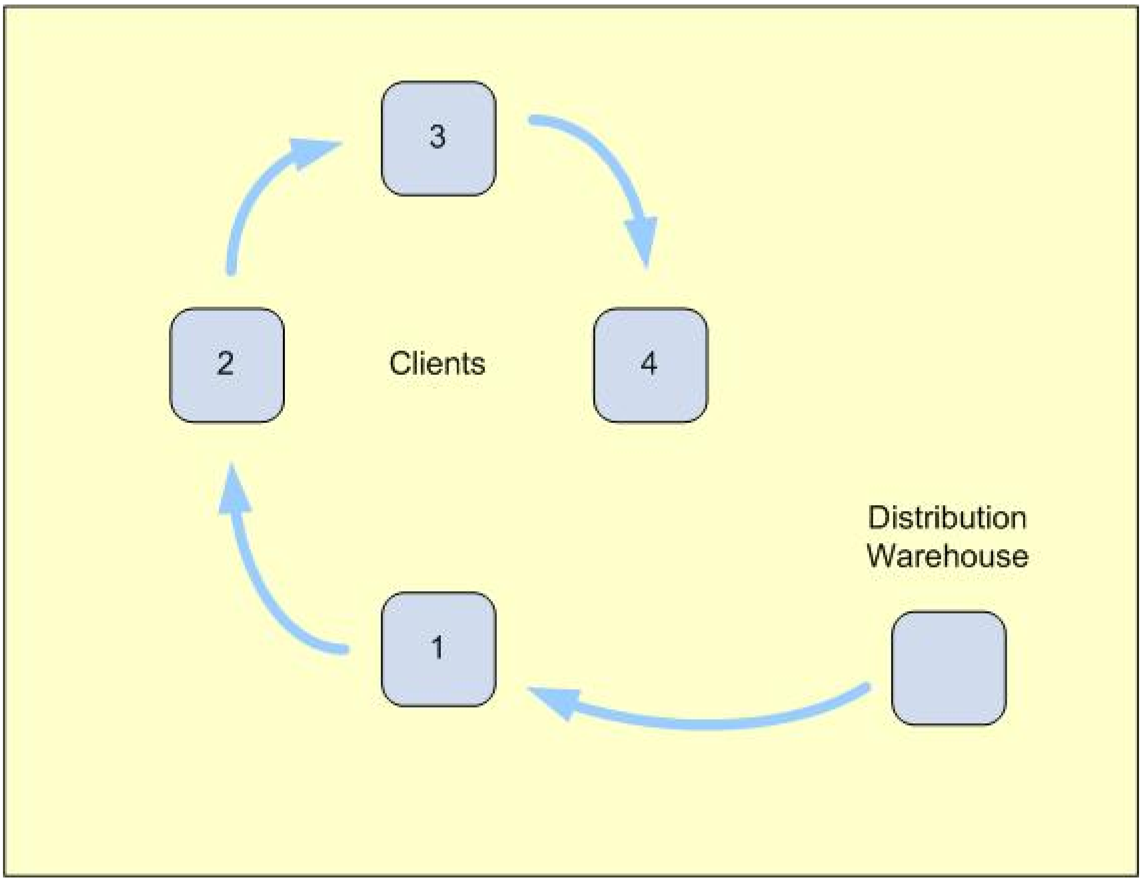

Figure 3.2 Urban Processed Food Distribution Chain : Common Form

Current Operations, Constraints and Possible Cases

Spiral Transport and Capital Liquor operate a distribution system to a range of liquor outlets in the Melbourne area. Consultations indicated that a primary constraint is the receival windows of clients, which typically start at about 09:00 and are timed to avoid peak retail periods for the respective business.

These receival windows have a number of implications for the structure and operation of the transport fleet, the primary ones being:

- a significant number of vehicles are required to operate in peak periods, in particular the Am-peak; and
- traffic congestion and parking restrictions near delivery points cause:
  - smaller, sub-optimal vehicles (from an efficiency perspective) to be used for the deliveries; and
  - multiple trips, later in each day, to service the set of demands.

Re-alignment of the clients' receival windows is thus likely to lead to a reduction in road freight trips and vehicle operating costs and, possibly, optimization in fleet structure and size. Through adjustments to business agreements (ie., flow-through of lower transport rates), this could lead to benefits to all parties in the liquor chain, and thus a sustainable outcome.

Case Study Scope, Timing and Resource Requirements

Consultations indicated that it is desirable and feasible to re-align the receival windows for the total set of Spiral-Capital clients, and that this warrants further consideration as part of an on-going FreightSmart Program. As far as immediate UCMWG requirements are concerned, discussions indicated that it was appropriate to focus the case study on a current distribution run which involved:

- a 'line-haul' (ie., from the DC to the first delivery) during the Am-peak period to a set of clients in the northern region of Melbourne; and
- deliveries to clients with current receival windows commencing from 9:00am.

The consultations indicated that it is not likely to be feasible to make major adjustments to the delivery schedule (ie., shift from day to night deliveries). However, it is likely to be feasible for the receival windows of 3-4 clients in the set of deliveries to be advanced by 1 hour (ie., to 8:00am). This would enable the delivery vehicle to complete the line haul operation before, or on the shoulder of, the Am-peak and to commence drops during the Am-peak.

Mapping of the Spiral vehicle operations for the above service was conducted, with the agreed primary tasks and outcomes being as follows:

- Assessing the feasibility of advancing the run schedule to the start of the Am-peak;
- Estimation of the likely reductions in travel time for the vehicles assigned to the run;
- Estimation of the likely impacts, if any, on the Spiral fleet productivity and size;
- Assessment of the likely impacts on clients' resources needed to enable the advanced delivery; and

- Estimation of the likely impact on road congestion for the set of roads which are involved in the Capital liquor distribution operations.

Details of this case study are contained in Appendix E.

3.3.3 Case 3 - Extended Cold Food Distribution Hours: Brisbane

Cold food distribution is a daily operation in major urban areas and involves movements between DC's and a set of clients (ie., food retailers). As with liquor deliveries, and depicted in Figure 3.2, it often involves a line-haul operation between the DC and a distribution area, then a series of drops to clients.

Current Operations, Constraints and Possible Cases

Swire-Frigmobile operates a distribution system to stores for a major food retailer in the Brisbane – Gold Coast region, and consultations indicated that there are a number of constraints on current operations which require vehicles to operate in peak periods and/or limit the optimization of fleet use. Four primary constraints, and the possible benefits-costs applying if they could be reduced/removed, are as follows:

1. Traffic management systems. There are several sites in which traffic management systems (eg., traffic barriers) limit the size of vehicles which can be used to service particular clients. Removal/reduction of these constraints could aid optimization of fleet use and, possibly, still meet social-environmental conditions for freight vehicle operation.
2. Pre-Am-peak delivery. The first main delivery phase is at, or shortly after, 6:00am. If the respective clients would agree to receive earlier then this could shift vehicles from the Am-peak and reduce vehicle operating costs. However, this might incur increased client staff costs and violate current 'night' noise restrictions in residential areas.
3. Daily operating cycles. The current daily operations involve three main cycles, with vehicles loading and departing the depot at about 6am, 10am and 6pm. If this cycle could be 'lagged' by, say, 2 hours (ie., to 8am, 12pm, 8pm), or if there could be a more significant shift of some daytime deliveries to night operations, there would be a reduction in peak period impacts and vehicle run times and costs. This change would be likely to have material benefits for the transport operator, but is currently restricted by night time noise restrictions.
4. Design of receival docks. The receival docks at several existing supermarkets in outer areas (eg., Gold Coast – Tweed Heads) restrict the size of vehicle which can be used for a delivery. Large docks would enable a larger vehicle to service several deliveries and thus significantly reduce the number of vehicles on the road network and optimise fleet utilisation.

Case Study Scope, Timing and Resource Requirements

Each of the above cases warrants consideration for inclusion in an on-going Program, with the shift in daily operating schedules (option 3, above) likely to cause a reduction in road freight trip numbers and increases in freight efficiency. However, to meet immediate UCMWG requirements, Case 2 (pre-Am-peak delivery) was considered to be the most appropriate for the Brisbane case study.

Swire-Frigmobile agreed to participate in the case study and mapping of the vehicle operations relating to a Pre-Am-peak delivery strategy was conducted, with the agreed primary tasks and outcomes being as follows:

- Identifying a sample of 5 vehicle runs which currently involve Am-peak operation in congested areas of Brisbane;
- Assessing the feasibility of advancing the run schedules prior to the Am-peak;
- Estimation of the likely reductions in travel time for the vehicles assigned to the runs;
- Estimation of the likely impacts, if any, on the Frigmobile fleet productivity and size;
- Assessment of the likely impacts on clients' resources to enable the advanced delivery;
- Estimation of the likely impact on road congestion for the set of roads which are involved in the Swire-Frigmobile distribution operations.

Details for this case study are contained in Appendix F.

3.3.4 Case 4 - Extended Container Park Hours : Sydney

There are similar issues to those indicated for Melbourne (in Section 3.3.1) relating to container park hours in Sydney . The P&O container park (POCP) is a significant provider of shipping container park services in Sydney, and VISA Australia provides container transport services which utilise POCP. Consultations with senior management from the two businesses indicated an interest in participating in a case study to assess the extension of container park hours. This case study took a similar form to that conducted in Melbourne (Section 3.3.1) and provided a means of testing for similarities in impacts and benefits across cities.

Mapping of the de-hire component of the import container supply chain was conducted. Through consultations with P&O and Visa it was agreed that primary tasks and outcomes would be as follows:

- Recording and documenting a profile of container movements by VISA, and build an overall Movement Profile that includes other operators using POCP;
- Estimation of current POCP costs and the likely changes resulting from extending hours;
- Estimation of the likely shift in distribution of VISA trips, and associated costs and benefits for VISA, under an extended hours strategy;
- Extension of the estimates for VISA to other transport operators using POCP;
- Estimation of the likely impact on road congestion for the set of major roads that are used to travel to/from POCP;
- Confirmation of or variation to congestion reduction estimates produced by preliminary assessment (Section 3.2.1).

Details of this case study are contained in Appendix G.

3.3.5 Case 5 – Re-alignment of Import Container Operations for a DC: Melbourne

This case involved a major retail DC in Melbourne supplying a range of household consumer products to its stores in Tasmania, Victoria, South Australia and the Northern Territory. The primary provider of transport for containerised product into the DC, and the removal of empty containers from the DC, is Patrick Logistics (PL). Consultations with senior management from the two businesses indicated an interest to participate in a case study to assess the extension of the DC's operating hours to enable the receipt and dispatch of containers to be shifted outside morning peak traffic conditions, particularly to pre-peak and evening periods.

The Retailer and PL agreed to participate in the study and the mapping of the activities associated with this component of the supply chain. It was agreed that primary tasks and outcomes would be as follows:

- Recording the container movement profile for the DC and identify peak period trips able to shift;
- Estimation of the DC operational costs associated with container movement activity;
- Assessing the feasibility of advancing the opening time of the retail DC to early Am (e.g. 03:00);
- Estimation of the costs and benefits for the DC of shifting trips to the extended hours period;
- Estimation of the likely impacts, if any, on the PL fleet's productivity and operating costs;
- Estimation of the likely impact on road congestion for the set of major roads that are used to travel to/from the DC.

3.3.6 Other Potential Case Studies

Consultations with Reference Group members and senior management in selected businesses indicated that there are several other possible case studies which would complement, and extend the information from, the five cases indicated in Sections 3.3.1 to 3.3.5, the primary examples being as follows.

Re-alignment of Activities for a Food Manufacturer: Brisbane

Industry and government agency consultations have indicated that a major food manufacturer in Brisbane is experiencing constraints on its inbound and outbound freight activities. This case study would relate to the food manufacturing sector, rather than just the food distribution sector.

Adjustment of Receival Hours for Building Materials: Sydney, Brisbane, Melbourne

Research relating to freight movement in Melbourne and consultations with supply chain agencies have indicated that there is significant movement of building materials in the Am-peak period and that these interact with other peak period traffic in a number of highly congested areas. Adjustment of the receival hours for these deliveries is likely to have a beneficial impact on congestion adjacent to the works areas.

Integration of Manufacturing-Warehousing-Transport Operations: Sydney

Industry consultations have indicated that the effective integration of manufacturing and warehousing facilities can, at times, be restricted by urban planning regulations. These can cause the warehousing of manufactured products to be located away from their manufacturing location, with resulting increases in the number of freight vehicle trips and road congestion.

A possible case study addressing re-alignment of manufacturing-warehousing activities in Sydney has been identified and would extend the coverage of FreightSmart case studies into the domestic manufacturing-distribution chain.

4. PART B - ASSESS AND SCOPE CASE STUDIES

The primary objectives of this part of the Project were to:

- use process mapping of the participating business(es) – to highlight the discrete linkages making up each supply chain, to identify current efficiency constraints and re-alignment opportunities and actions, and to capture 'benchmark' data relating to impacts, costs and benefits for the participating business(es);
- confirm and, if necessary, extend available data, analysis and evaluation frameworks, in order to be ready to quantify business and industry level impacts, urban system impacts and, if appropriate, wider economic impacts from case studies; and
- apply the evaluation framework in practice to assess the likely costs and benefits from each of the five case studies outlined in Sections 3.3.1 to 3.3.5.

4.1 Process Mapping and Evaluation Frameworks

To define and scope each case study it was necessary to undertake process mapping to identify constraints and potential re-alignment actions, and evaluation of the impacts and costs for the proposed re-alignment action(s). While the particular tasks required for the mapping and evaluation varied across the cases, it was possible to specify generic frameworks for mapping and evaluation, and they are outlined in Appendices B and C, respectively.

4.2 Primary Findings from the Case Studies

Details of the mapping processes and the resulting information and findings for each of the case studies are given in Appendices D to H. The primary overarching findings from the case study assessments are summarised in the following sections.

4.2.1 Constraints and Re-alignment Potential across Urban Supply Chains

The process mapping for the five case studies indicated that:

- there are constraints at several nodes along shipping container supply chains (ie., container park, distribution centre, importer depot) that are causing a significant percentage of urban container movements to be made in Am-peak or Pm-peak periods;
- there are constraints in other urban supply chains, in particular the food chain, that are causing a significant percentage of urban container movements to be made in Am-peak or Pm-peak periods; and
- it is feasible and desirable that an 'integrated' re-alignment strategy for container and food supply chains be developed and implemented, involving alignment of activities occurring at several nodes in the chains.

4.2.2 Urban Congestion Reduction

Evaluation of the impacts of re-alignment on the specific shipping container and food chains addressed in the case studies was expanded to achieve a strategic estimate of total and citywide benefits obtainable from the extension of modelled re-alignments to apply across the whole of the particular supply chain and transport sector studied. This expansion was based on available data regarding the proportion of each city's road freight transport task that is accounted for by the supply chain in question (Section I.1, Appendix I). This analysis indicated that a shift in truck trips from the Am-peak to the night-time period resulting from re-alignment actions could lead if achieved to measurable reductions in trips contributing to the congestion of urban arterial roads. The expanded outcomes for each supply chain are estimated as follows:

- Melbourne shipping container chain re-alignment. This could lead to reductions of:
    - 1,000 veh-hrs/day travel time for cars (including light commercial vehicles [LCV's]) and 200 veh-hrs/day for heavy commercial vehicles (HCV's); and
    - $4 million/year in generalised road user costs.
- Sydney shipping container chain. This could lead to reductions of:
    - 500 veh-hrs/day travel time for cars (including LCV's) and 250 veh-hrs/day for HCV's; and
    - $2 million/year in generalised road user costs.
- Brisbane cold food chain. This could lead to reductions of:
    - 900 veh-hrs/day travel time for cars (including LCV's) and 100 veh-hrs/day for HCV's; and
    - $3 million/year in generalised road user costs.
- Melbourne food chain. This could lead to reductions of:
    - 1,800 veh-hrs/day for cars (including LCV's) and 300 veh-hrs/day for HCV's; and
    - $4.5 million/year in generalised road user costs.

The analyses also indicated that:

- there would be additional travel time, congestion and user cost reductions during Business and Pm-peak periods; and
- a high economic return would be obtainable from achieving re-alignments, given the relatively low cost of effecting necessary changes (eg., as market adjustment incentives).

4.2.3 Vehicle Fuel and Emission Reduction

This order of reductions in vehicle hours of travel (Section 4.2.2) would lead to reductions in vehicle fuel consumption and emissions for each of the supply chains shown in Table 4.1.

Table 4.1 Estimated Reductions in Fuel and Emissions from Re-alignment

Variable	Melbourne Container case	Brisbane Cold food case	Sydney Container case
VHT	-1.2%	-0.8%	-1.5%
Fuel	-1.1%	-0.7%	-1.4%
HC	-1.4%	-0.9%	-1.7%
NOx	-0.5%	-0.3%	-0.7%
CO2	-1.1%	-0.7%	-1.4%

4.2.4 Productivity and Economic Efficiency Increases

Truck operators who would benefit from the possible re-alignment actions indicate that the estimated reductions in vehicle hours of travel would also lead to increased productivity in existing truck fleets or, possibly, reductions in fleet size for the same freight task (Section I.1, Appendix I).

Supply chain-specific savings in travel costs and increased fleet productivity would be likely to deliver flow-on benefits in the form of increased GDP growth from more efficient freight and business travel. The estimated value of the additional GDP growth was estimated to be of the order of $2 million / year for the Melbourne shipping container chain re-alignment case. Comparable additional benefits could be expected to occur for the other three re-alignment cases.

4.2.5 Market Transfers or Adjustments

As indicated in Appendices D to H, each of the re-alignments would result in significant net benefits for the impacted section of the supply chain. These would be achieved as a result of transport operators directly experiencing improved efficiencies, but with benefits being partly offset by increased costs to a supply chain node required to modify operating hours (eg., container park, retail store).

Therefore, to achieve the necessary re-alignment it is likely that forms of benefit ‘transfer’ or ‘market adjustment’ processes would be required, to ensure that constraints on improved efficiency are reduced, ramp-up to a re-aligned structure occurs and sustainable outcomes are reached. While transport operators indicate a willingness to pass on some component of their own reduced costs through reduced transport rates, it is likely that they would not do so until these could be confirmed. To facilitate confirmation of cost reductions and net benefits it is desirable that Parts C and D of the Project be implemented, with funding for operating cost increases underwritten for a specified, short time period.

5. RECOMMENDED FREIGHTSMART ACTIONS

The findings from Parts A and B of the Project indicate that the case studies and an on-going FreightSmart Program are likely to return reductions in urban road congestion, and associated benefits in the form of reduced travel costs, fuel consumption and vehicle emissions. In some locations there could be increased night-time noise impacts as a consequence of changed operations.

A number of actions are required to progress the case studies and the development of an on-going FreightSmart Program, and the highest priority recommended actions are summarised in the following sections.

5.1 Implementation of the Case Studies for Suitable Time Periods

It is recommended that the proposed Parts C and D of the Project be implemented, with the primary actions being as follows:

- ***Implementation of each of the five case studies (Appendices D to H)***. It would be beneficial for this to commence in the Oct-Nov 2006 period, to ensure that partner business support for initiatives is maintained and that impacts be assessed for the non-Christmas/New Year period.
- ***Other potential case studies***. Other case studies have been identified in Brisbane and Melbourne during Part B, and would complement the five case studies conducted to date. They are recommended for completion during Part C, with a view to subsequent implementation in an ongoing FreightSmart Program.

5.2 Industry Information and Education Program

Consultations with businesses and freight transport industry stakeholders during Parts A and B of the Project have indicated that there is a low awareness of the potential efficiency benefits from supply chain re-alignment, and a positive interest when these can be demonstrated. The following action is therefore recommended, to complement the implementation of the case studies during Parts B and C.

- ***Industry information and education programs***. Adapt the information from the case studies into forms suitable for increasing industry awareness of the benefits from re-alignment and actions which they can take to achieve these. Information could include information brochures and industry workshops, conducted in association with the relevant transport and supply chain agencies.

5.3 Night-Time Noise Constraints and Congestion Trade-offs

The estimates of reduced road user costs and increased GDP growth (Appendix I) indicate the economic value which can be derived from the shift of some freight-related activities to night-time periods. If these shifts were prevented to minimise the amenity impacts of night-time truck operations then this estimated economic value should be taken as reflecting the implicit trade-off being made between night-time noise levels and daytime road congestion.

The estimates of road user and economic benefits from supply chain re-alignment could be used as the basis for consultation with community groups and other relevant parties to determine an acceptable trade-off between noise and congestion levels.

5.4 Development of an On-going FreightSmart Program

The findings of the Project indicate that re-alignment actions addressing several sections of the studied urban supply chains could reduce urban congestion and emissions and increase freight transport efficiency. Further, there would be commercially sustainable benefits to individual businesses in these chains. To facilitate re-alignment actions, and their effective integration with other short and long run congestion reduction and freight efficiency initiatives, it is recommended that the following steps be taken as a part of an on-going FreightSmart Program.

- ***Continued re-alignment case studies***. These would focus on sections of the supply chains not covered by the cases in Part B (eg., shipping container movements to and through distribution centres, distribution of building materials to sites).
- ***Re-alignment and traffic management case studies***. These would focus on studies which address the integration of re-alignment actions with traffic management actions, to ensure optimisation of personal and freight transport operations. They would also look for opportunities to link FreightSmart re-alignment actions to complementary initiatives by Reference Group members, such as the use of the Intelligent Access Program to enforce changed freight transport operating hours available to participating operators.

5.5 Integration of Supply Chain Re-alignment and Strategic Location Decisions

The consultations with SCOT UCMWG and Reference Group members and with major supply chain businesses have indicated that:

- businesses are frequently undertaking strategic reviews, including the location of their facilities; and
- it is desirable that supply chain re-alignment and location of facilities be jointly considered.

It is therefore recommended that the FreightSmart Program also include cases which consider the integration of supply chain re-alignment and strategic location decisions by businesses and agencies, in particular the location of freight-related activities.

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APPENDIX A PRELIMINARY ASSESSMENT OF CONTAINER TRANSPORT OPERATIONS AND RE-ALIGNMENT STRATEGIES

A significant component of the containers imported and exported through the Port of Melbourne (PoM) are reefers (ie., temperature controlled containers). The Melbourne-based operations of Chalmers Transport uses a medium size vehicle fleet and provides a range of transport and storage services, including the transport of reefers.

Data on imported reefer movements by Chalmers from the PoM to importers in Melbourne was obtained for March 2006. This data was sufficient to enable a preliminary mapping of the freight vehicle trips involved in the transport of imported reefers in Melbourne, identification of current constraints and potential re-alignment strategies and evaluation of the potential impacts and benefits from the re-alignment.

This Appendix provides a summary of the primary findings relating to supply chain changes.

The most efficient transport operation for the movement of an imported reefer would involve two freight vehicle trips and associated actions at the supply nodes, these being:

- Trip 1 : wharf-to-importer, with the vehicle holding at the importer while the container is un-stuffed; and
- Trip 2 : importer-to-container park, to de-hire the container.

From a congestion management perspective, the least impact on road congestion will occur if these container transport trips occur during night time periods.

The preliminary mapping of the actual vehicle trips indicated the following operational characteristics for an imported reefer.

- Up to four truck trips, as depicted in Figure A.1. This includes a ‘hold’ of at least one night at the transport depot, for both the movement for the wharf-to-importer movement and the importer-to-container park movement.
- Significant percentages of the trips to the importer occur in the Am-peak, Business and Pm-peak periods. There is scope for receivals as late as 21:00, but only a small percentage being received in night periods.
- Significant percentages of the trips to the container park are in the Am-peak, with no receivals after 16:00.

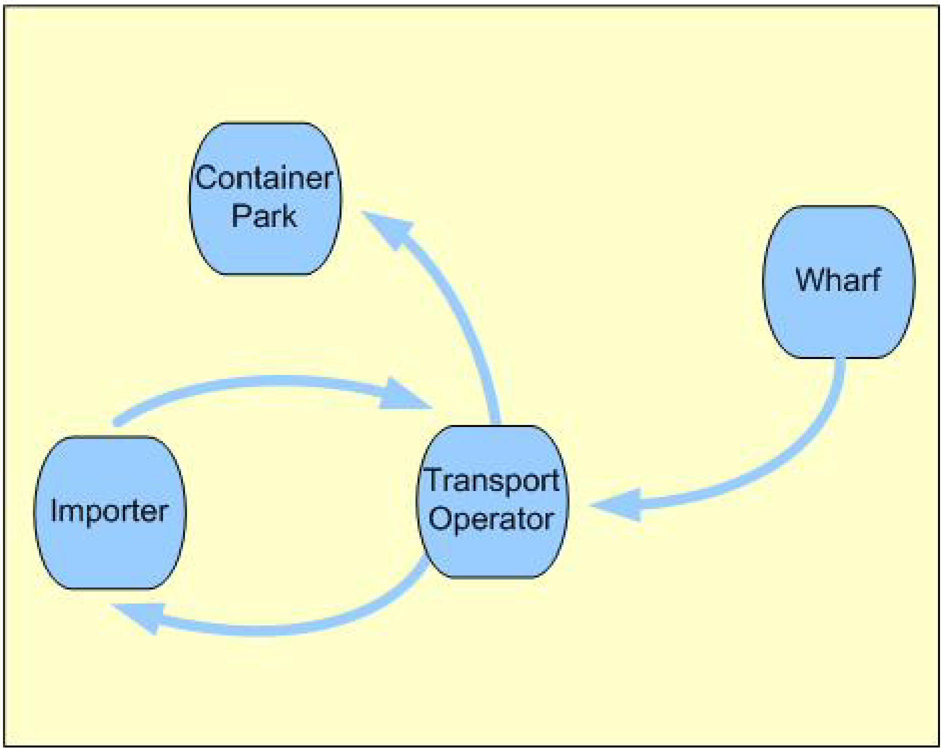
These observations imply that:

- the container park operating hours (06:00 – 16:00) are constraining trips for container de-hire, causing:
    - an additional overnight ‘hold’ of the container at the transport depot; and

    - a trip during the Am-peak.
- the importer receiving facilities can receive reefers during Business hours and through to 21:00 at night, but current operating arrangements appear to be constraining a significant percentage of the reefers to be received during the Am-peak and Pm-peak periods.

To fully explore the causes of the above import reefer receival arrangements and vehicle trips it will be necessary to undertake more detailed mapping of the activities along the wharf-operator-importer-park hours. This was beyond the scope of this preliminary assessment, but consultations with relevant parties have indicated that the following three re-alignment strategies and associated freight vehicle operational and congestion impacts are possible.

- Strategy 1 - Extend the container park hours to 21:00. This would enable most, or all, of the 30% of the Am-peak trips (Table A.1) to 'shift' from the Am-peak, and possibly to the post-Pm-peak period (ie., 19:00 – 21:00).
- Strategy 2 - Re-structure the importer receival hours to shift the Am-peak receivals to the Business period or evening periods (ie., 19:00 – 21:00), which are within the current operating hours. This would enable most of the Am-peak receivals to move to less congested periods.
- Strategy 3 – Combine strategies 1 and 2.



1 Reefer containers are temperature controlled.

Figure A.1 Typical Trip Sequence for Import Reefer[1] Container Movement

Table A.1 Vehicle Arrival-Departure Times for Reefer Movements for an Average Weekday[1]

Time period	Importer	Container Park
Am-peak (0700-0900)	30%	25%
Business period (0900-1600)	45%	75%
Pm-peak (1600-1800)	20%	0%
Night (1800-0700)	5%	0%
Total day	100%	100%

1. The estimates are based on a sample of reefer movements for a selected month in 2006.

APPENDIX B PROCESS MAPPING AND CASE STUDY SCOPING

The process mapping procedures were tailored to suit the structure and scope of the case studies indicated in Section 3.3. The data items captured in the mapping for each business and the flows to the Strategic and Evaluation components are depicted in Figure B.1, and brief descriptions of the data items and their importance are as follows.

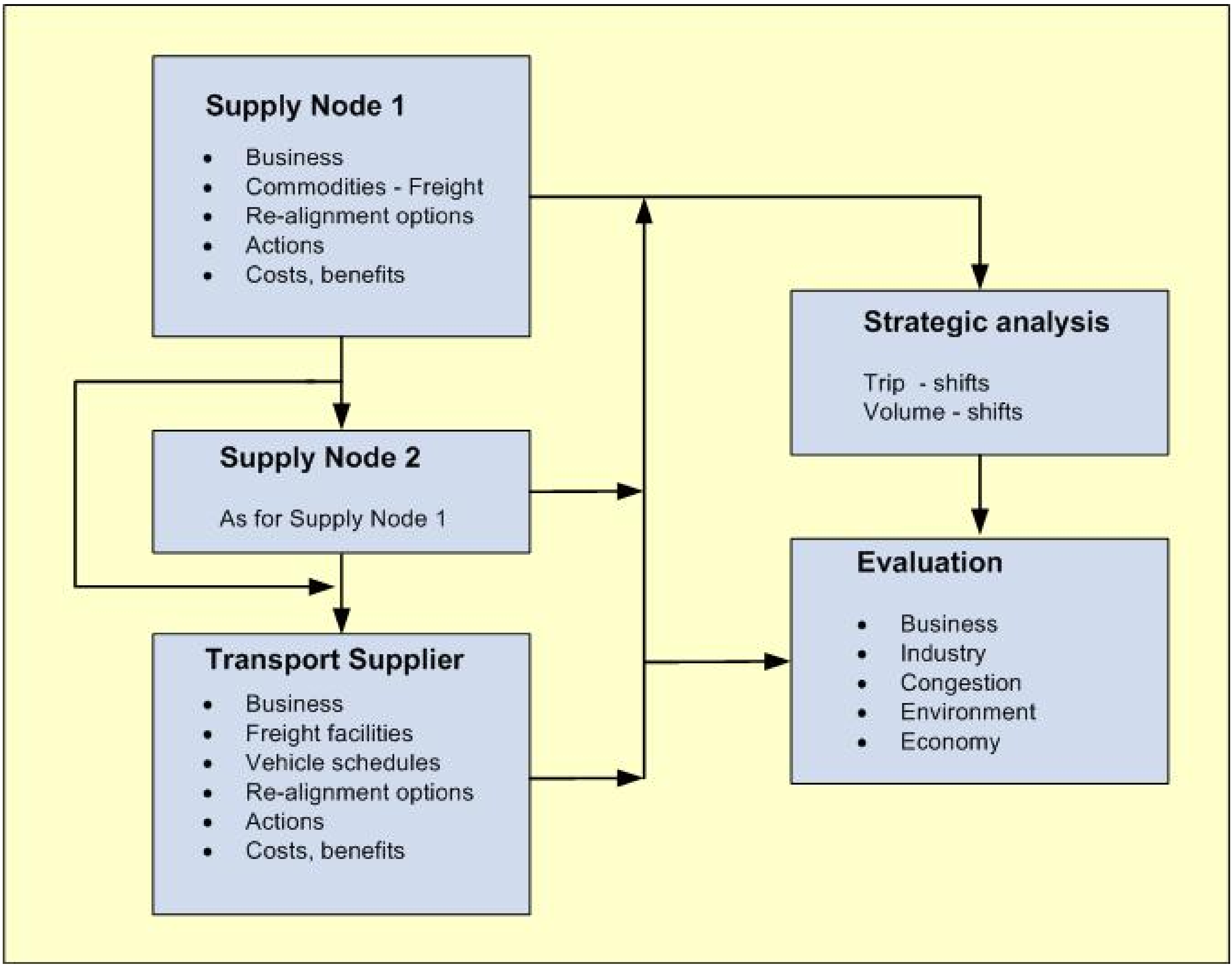


Figure B.1 Data Items and Information Flows from Process Mapping

- ***Supply Nodes***
  - Industry(ies) engaged in by the business, by ANZSIC classification.
  - The quantity of commodity consumption and production by commodity (ANZSCC) and industry (ANZSIC) classes for an average week, if appropriate, for the supply node.

   - The quantity of freight movement by commodity class and mode, related to the case study:
     - to ‘downstream’ supply nodes (eg., manufacturers, DC’s), with nodes classified by industry classes for an average week; and
     - the proportions for these movements which occur in Am-peak, Business, Pm-peak and other periods of the workday.
   - Constraints to efficient supply chain and off-peak freight transport operations, and re-alignment options to reduce these constraints and shift freight trips to off-peak.
   - Actions to achieve the re-alignment, and the impacted parties (eg., transport supplier(s)).
   - Costs and benefits to the ‘target’ business, with these being preliminary in Part B of the study.

- ***Transport Supplier***
   - Transport and associated services engaged in by the business (eg., container transport, storage), related to the case study.
   - Freight fleet structure and freight storage-handling facilities (if appropriate), related to the case study.
   - Current freight vehicle schedules for the freight vehicle(s) impacted by the re-alignment for the Case Supply Node(s), for the average work-day and the periods within the day (eg., Am-peak).
   - Expected changes to the vehicle schedules for the effected time period, and for the total day (ie., the full day impacts).
   - Costs and benefits for the business fleet, with these being preliminary in Part B of the study.

The above industry and commodity classifications, quantities of commodity production and freight movements, by mode and time period, and daily freight vehicle schedules provided:

- a precise description of the stage in the supply chain that the case business is located, and the upstream and downstream linkages; and
- a statistically rigorous basis for estimating the strategic and economic impacts and evaluating the costs and benefits for businesses, industry segments, urban travel system and the broader economic system (see Appendix C).

B.1 Scoping FreightSmart Projects

The data and general business ‘intelligence’ drawn from the above tasks enabled scoping of each of the cases, to induce the identified re-alignments. This involved the following tasks, related to the case study.

- ***Specification of the re-alignment actions required by each business***. These included consideration of one or more of the following actions.
   - Re-scheduling the time periods for receipt and/or dispatch of freight, including empty containers, to facilitate off-peak operation of freight vehicles.
   - Re-structuring or extending freight receipt, dispatch, storage or handling facilities, and associated labour arrangements, to achieve higher productivity and efficiency.

  - Re-scheduling or re-configuring of freight vehicle fleets, to reduce peak or total hours.
  - Adjusting freight rates, in response to efficiency gains for transport suppliers, providing 'transfers' of costs and benefits between the participating businesses.
  - Identifying and estimating the likely costs and/or benefits for the set of changes in each business.
- ***Specification of the actions required by public sector agencies***. These included consideration of one or more of the following actions.
  - Relaxing of freight operating hour restrictions in relevant restricted neighbourhoods.
  - Discounts for truck operations which shift to off-peak periods (eg., waive Port Container surcharges, provide financial incentives with lower tolls in off-peak periods).
  - Financial support for the businesses, to aid implementation.
- ***Updating the process map to provide 're-alignment' maps***. These:
  - identified the components of the supply chain process which are expected to change; and
  - set a basis for auditing the evaluating the changes during and after implementation, in Parts C and D.

APPENDIX C SUPPLY CHAIN EVALUATION FRAMEWORK

This appendix outlines the Evaluation framework for the supply chain re-alignment projects, which was used in the current Project and can be used in the on-going FreightSmart Program. The Project brief required that during his Project the re-alignment projects be referred to as 'case studies', and this term is used in this appendix and in the main sections of the report.

C.1 Re-alignment Problem and Project Definition

A number of the supply chain alignment problems identified to date, through previous projects and this Project, involve some form of market failure or constraint, through regulation or development processes. The re-alignment projects are therefore essentially seeking to correct these market failures or regulation-development constraints and, thus, reduce the congestion impacts and freight inefficiencies.

Market Processes and Interventions

The ability of re-alignment actions to achieve the desired congestion and freight efficiency objectives will depend on the: behaviour of specific markets and parties along the supply chain; the distribution of costs and benefits along the chain; and, possibly, regulations which prohibit changes by the parties.

The urban supply chains straddle a number of different markets, with varying degrees of semblance to the basic principles of competitive or efficient markets. The trucking industry, for example, has many of the features expected of a competitive market and, generally, cost savings are passed-on quickly through competitive processes. However, freight terminals and international shipping, as a result of limited numbers of suppliers and service differentiation (e.g., specialisation), have features that suggest some market segments are closer to natural monopolies, at least in the short run. The structure of these markets will influence the type and scale of re-alignments and, possibly, the manner in which benefits of the re-alignments might be distributed amongst parties.

Studies to date have indicated the fragmented nature of some supply chains and the diversity of the participants. This has contributed to alignment problems and leads to the following two evaluation and intervention considerations.

- ***Distributions of benefits***. In the process of attaining the economic benefits of supply chain re-alignments, there will be parties that would benefit and others that would incur additional costs. There will thus be a need to provide market-based mechanisms to distribute net benefits along the chain so that all parties have an incentive to participate. This requirement is discussed further in Section C.5 below.
- ***Economic regulation***. Economic regulation, which aims to foster competition, has been averse to vertical integration. There are numerous cases under the Trade Practices Act that have seen an intermediate producer seek access to an upstream product from a vertically integrated supplier on the

same terms as given to the vertically integrated firm's downstream producer. The need to ensure that all parties along the supply chain benefit from the potential re-alignment, partly explains the spate of industry consolidation over the past decade. For example, by owning a terminal business, a transport business and a distribution centre, a single firm can derive benefits from improved supply chain alignments by internalising the chain into an integrated operation, ultimately, under single management control. Consequently, some form of government intervention is justified in order to capture the benefits of supply chain re-alignment without reducing the logistics market to a small number of larger players. The form of intervention required may be no more than informational (ie., reporting the findings of a study such as the current one).

Regulation or Development Constraints

The process of development of the case studies for this Project has indicated that in several sections of the urban supply chains, businesses are seeking to improve the alignment with other businesses, but are prevented from pursuing this by current regulation or development constraints. The constraints include:

- environment protection orders, prohibiting increased night time freight deliveries;
- traffic management schemes, which limit the size of freight vehicles which can be used to access freight drop locations (eg., retail outlets);
- land-use planning regulations, which can restrict the integration of the production-storage-distribution chain; and
- freight vehicle docking facilities in commercial developments (eg., retail outlets), which restrict the size of freight vehicles which can be used for freight deliveries and thus increase the number of freight vehicles on the road network.

Re-alignment Problem and Project Definition

In this Project the evaluation of each urban supply chain re-alignment project therefore commenced with:

- the definition of the form and causes of the current supply chain constraint(s) which are contributing to road congestion and restricting freight efficiency, in particular the:
  - structure of markets and limitations of existing economic regulation and market realities to achieve supply chain efficiencies;
  - existence of regulation or development constraints; and
- a description of the re-alignment project(s) that will reduce the constraint(s).

The following sections outline the principles, variables, parameters and procedures which are appropriate for evaluating supply chain re-alignment projects.

C.2 Supply Chain Re-alignment Evaluation Framework

The following two primary forms of analysis are used to evaluate supply chain re-alignments.

- Project cost benefit analysis (CBA), which estimates NPV and/or Cost-benefit of the project, using estimates of discounted streams of benefits and costs. This is for both economic evaluation to assess the societal benefit of re-alignments, using resource costs, and for financial evaluation, using the financial costs faced by each of the participants along the supply-chain, abstracted for the project.
- Economic system impacts, which estimates the ‘flow-through’ to the broader economy, and change in the economy, resulting from changes in costs and outputs for businesses and industries in a particular stage of the urban supply chain.

Procedures to conduct a strategic CBA of supply chain re-alignments were outlined by the IMIS Team in the previous SCOT Supply chain report. These are appropriate for this Project and the primary variables, parameters and procedures are considered in Sections C.3 to C.7.

The variables and procedures for evaluation of the wider economic system benefits are described in Section C.8.

Project Ramp-up and Time Frame

The mapping process for each re-alignment project considered the following temporal variables, required to develop a discounted cashflow analysis (economic and financial).

- Ramp-up profile. This reflects the speed with which changes can be adopted by businesses and industry (discussed below under Transfers and Rigidities, and related to fleet savings).
- Timing of expenditures, in operating and capital costs, and benefits.
- Duration of project life. The continual industry change, as a result of technology and changing patterns of trade, indicate that a project life for analytical purposes beyond ten to fifteen years is probably unlikely. Discussion with businesses will identify trends that are likely to ‘overtake’ the benefits of these re-alignments, while identifying how such processes may then raise fresh opportunities for re-alignment. The application of a taper-out profile is likely to be an appropriate method of handling project duration considerations in the evaluation.

C.3 Supply Node Business Costs and Benefits

The primary activities at any supply chain node, irrespective of the nature of the commodities, include inbound transport, unloading and receival processes, storage, order picking, dispatch to manufacturing and/or customer and outbound transport. All of these activities utilise labour, plant and property and the total supply node cost associated with a particular freight vehicle trip which arrives in period ‘t’ can be broadly expressed as:

$$\text{Node Costs}_t = \text{Receival Costs}_t + \text{Inventory Costs} + \text{Processing Costs} + \text{Dispatch Costs} \quad (C.1)$$

Re-alignment actions are likely to cause changes in costs within one or more of these Node cost components. The assessments to date have indicated that the set of variables listed in Sections C.3.1 for container parks and C.3.2 for generic supply nodes are likely to apply to the evaluation of re-alignment projects which cause changes in supply nodes.

C.3.1 Proposed Variables Relating to Supply Nodes – Container Parks

The proposed variables to evaluate cost changes and associated benefits at container parks are as follows.

- Receival costs.
    - Variable 1 – labour cost
    - Variable 2 – supervision cost
    - Variable 3 – security costs
    - Variable 4 – operating costs (lighting, power, etc;)
- Inventory costs.
    - Variable 1 – storage requirements
    - Variable 2 – operating cost (e.g., power for reefer)
- Processing costs.
    - Variable 1 – labour cost
    - Variable 2 – equipment cost
- Dispatch costs.
    - Not affected, unless longer hours lead to deliveries to wharf over an extended period or unless egress is via a separate gate to access, and additional staff are required at that gate.

C.3.2 Proposed Variables Relating to Generic Supply Nodes

The proposed variables to evaluate cost changes and associated benefits at generic supply nodes (eg., retail outlets, manufacturing plants, distribution centres) are as follows.

- Receival costs.
    - Variable 1 – labour costs
    - Variable 2 – supervision costs
    - Variable 3 – security costs
    - Variable 4 – operating costs (lighting, power, etc;)
- Inventory costs.
    - Variable 1 – The impact on inventory cost is likely to be minor. However, if extended receival and dispatch hours results in longer dwell time in the node, then there may be capital cost implications for the node, including: sufficient racking/storage capacity; and possibly, additional peak crane / retrieval capacity.
- Processing costs.
    - Variable 1 – labour cost

  - Variable 2 – equipment cost (e.g., fork, crane, etc;)
- Dispatch costs.
  - Variable 1 – labour costs
  - Variable 2 – supervision costs
  - Variable 3 – extra dock space
  - Variable 4 – additional access capacity.

C.4 Transport Costs and Benefits

Total transport costs faced by the transport operator will be a function of all the activities undertaken by the freight vehicles, their cycle time, and hours of operation. The movement of containers between a distribution centre (DC) and a container park (CP) can involve the following variables, which are also commonly involved for other freight transport operations.

1. Travel time from DC to CP
2. Queue time at CP
3. Service time at CP
4. Travel time from CP to DC
5. Queue time at DC
6. Service time at DC

The transport cycle time is the aggregate of these times and determines fleet size for a given freight task, based on hours of operation. Re-alignment of the supply-chain has the potential to:

- reduce travel times by re-timing trips to periods out of the peak;
- reduce queue times by spreading the arrivals at the CP and DC; and
- increase fleet productivity, or enable reductions in fleet size.

It is unlikely that service times would alter within the scope of the supply chain re-alignments being considered. The mapping process was structured to test this.

Consultations with businesses indicate that, in addition to the above elements of the container transport cycle, there are staging points, where containers are stored for short periods (usually at the transport depot) on the way from the wharf to the DC, or on the way from the DC to the CP. This staging typically results from one or both of the following factors.

- The arrival of containers at wharf prior to it being required at DC (i.e., early arrival to ensure reliability of supply – float in the chain). Storage in the transport depot (rather than at wharf) is to avoid higher storage charges at the wharf and to bring the box into the landside supply chain ahead of requirement at DC.
- Empty boxes leaving the DC late in the day when there is insufficient time to get to the CP prior to closing.

The mapping process identified the key flows between nodes in the different types of supply chains, including staging, as well as the rationale for staging in individual cases. This permitted savings to be estimated more accurately (e.g., faster movement through the chain, with less staging, appears to offer the potential to reduce the complexity of chain management and to avoid some demurrage costs).

Through the process of extended operating hours, in combination with reduced travel times and reduced queue times, the cycle time would reduce and the total number of cycles per day per truck could increase. This improved productivity would reduce the fleet size required for the same freight task. This is likely to provide fleet size savings; the mapping process will assist to identify the likely response of the operators to this outcome and provide an indication of how these benefits would be valued.

At a strategic level the generalised cost of travel for a truck trip between two locations in a time period ‘t’ (eg., Am-peak), can be defined by:

Travel Costs $_t$ = VTT * Travel time + Direct costs (eg., tolls, parking, terminal charge) (C.2)

where VTT is the Value-of-Travel Time, for the particular trip purpose / vehicle class / time period.

The following primary travel cost components are likely to be relevant to the projects.

- ***Travel time***. Under several of the project actions the travel times could change through either:
  - shifts to non-peak time periods, with reduced times for current truck trips and total vehicles in the Am-peak period; or
  - reduced truck trips (ie., direct movement from producer to port).
- ***Value-of-travel time (VTT).*** Under several of the project actions the VTT could change through either:
  - increased driver pay rates, for shifts from day to night time operation; or
  - reduced vehicle fleet costs, through more efficient use or reductions in truck trips.
- ***Toll costs and revenues***. Toll costs could reduce through ‘trip time discounts’, if these are offered to operators which shift the time of trips.

In addition to the travel costs, the transport operator faces changed delay costs at supply nodes. These costs comprise:

Queue costs = Queue time * idle time cost (C.3)

The idle time cost in financial terms will come from operators and may differ from the total hourly cost. In economic terms the opportunity cost of the idle time is running time on the road, and will be valued as such, less the resource cost actual of vehicle operation.

C.4.1 Proposed Variables Relating to Transport Operators

Given the above components of the transport operations, the proposed variables to evaluate cost changes and associated benefits for transport operators are as follows.

- Travel costs.
  - Variable 1 – travel time between nodes in the chain
  - Variable 2 – temporal pattern of demand
  - Variable 3 – financial cost for travel time
  - Variable 4 – resource cost for travel time
- Terminal costs.
  - Variable 1 – queue time
  - Variable 2 – idle time financial cost
  - Variable 3 – idle time resource cost
- Fleet capital costs – The abstraction of these as project costs appears feasible, although the mapping process will establish their magnitude and the ability to abstract them as project costs.
  - Variable 1 – component of hourly rate that represents incremental fleet cost
  - Variable 2 – change in hire-in of sub-contractors
  - Variable 3 – changes to fleet renewal process
  - Variable 4 – estimated value, in terms of reduced noise and air pollution externalities resulting from greater vehicle utilisation (i.e., fewer cold starts per tonne-km; higher fleet turnover, speeding diffusion of new emission control technology through fleet)

The business mapping process for the Transport Supplier(s) was structured to identify and to quantify the relevant transport operator cost changes.

C.5 Transfers, Incentives and Rigidities

As indicated in Section C.1, it is likely that the re-alignment project evaluation process will need to consider transfers between parties in the supply chain. Ideally these should occur through market forces (eg., a component of the benefits to truck operators passing-on through reduced trucking rates). However, to facilitate the change process it is likely that some form of incentives will be required. The relevant issues and procedures are considered further in Sections C.5.1 and C.5.2.

C.5.1 Transfers and Incentives

Assessments to date have indicated that some supply chain re-alignments will come about through changes in the operation of nodes and transport operators. To proceed, these changes ought to provide net project economic benefits for the community. It is anticipated that project financial savings will accrue for at least one of the parties, most likely the transport operator. It is also possible that increased project costs will accrue for other parties (eg., container park operators, retailers).

If there are net project economic benefits from the re-alignment then this would indicate that such re-alignments will improve social welfare and, therefore, are worth pursuing. For the party reaping savings, the incentives to alter their operations are obvious – financial improvements and a commercial advantage. However, the part(ies) facing higher costs are unlikely to enter into a course of action that would reduce their commercial position. Consequently, a process to distribute overall benefits of re-alignment will be required to ensure all parties have an incentive to participate. This would enable, for example, a proportion of project savings to pass (or transfer) from the transport operator to the node operator to provide them with the commercial justification to alter their operations, and enable the re-alignment to proceed.

Ideally, a market-based re-distribution process would be identified and consultations to date have indicated that transport operators and their rates are responsive to cost reductions and/or productivity gains. Thus, incentives are likely to be required only in particular cases, and for a limited time, to accelerate the changes and identification of benefits.

The evaluation process will establish, through project financial analysis, an estimate of the size of the material project financial benefit and material project financial cost to both these types of parties. This will provide an indication of:

- the likely re-distribution of benefits required to achieve action with the node operator, so they have an incentive to participate; and
- the net benefit that would remain with the transport operator after they have forgone part of it to the supply node.

How the benefit transfer scheme might work would be explored through the mapping process. Once the size and distribution of benefits and costs are established, an assessment of the appropriate re-distribution mechanism can be made. As an illustration, in the case of extended hours of operation of a node facility that would permit freight trips to occur out of peaks, it might be as follows.

- An extended hours surcharge, paid to the node operator by the transport operator. This charge would need to cover the incremental costs faced by the node operator plus some reasonable margin for risk and profit. The charge would need to be less than the net saving to the transport operator, so that the transport operator is still achieving a financial benefit.
- An alternative would be for government to fund the additional cost of the node operator's labour, at least to facilitate the conduct of case studies under this Project. The point of this would be to ensure all parties engaged with the project by reducing the up-front co-ordination and management sign-off required. Depending on the quantum involved, the overall benefit to the node operator of extended hours (if the transport operators respond), as a result of increased capital utilisation at the node, may offset the incremental cost of labour, meaning no incentive scheme is actually necessary to achieve these outcomes in the future. However, the role of the project would be informational to demonstrate to other node operators that, under real world conditions, extended hours of operation is commercially advantageous.
- A longer term strategy, should this approach to urban congestion management extend beyond the case studies in this Project, might be to consider a sophisticated form of road user charging, that levies heavy vehicles for the road space used by time of day. Peak period permits would be rationed and would attract the highest charge; possibly through an auction

process. Permits at other times of the day would have lower costs. Operators would bid for peak period permits, this would ration the peak period 'slots' (using price) to the highest value users. This would provide transport operators with an incentive to pay for after hours or extended hours opening times at nodes, because they would pay less for road use. Clearly such a scheme would need further thought and has potential to design in a number of innovative features – for example, evening slots may have a negative price, with funding from the pool of receipts from the peak slots, in this way the net financial cost to industry of the permit scheme may be zero; yet it might still provide net economic benefits to the community from lower congestion.

C.5.2 Rigidities

The road transport industry is highly competitive, with many features of a competitive market. Consequently, it is anticipated, and industry feedback to date supports this view, that savings due to improved operations will be passed through to users quickly as a result of competition. However, the mapping process was structured to identify possible 'rigidities' that might affect the magnitude and time frame for flow-on of cost reductions, including:

- term contract arrangements with suppliers or customers;
- availability of finance to fund capital improvements and increased working capital;
- labour agreements; and
- the level of market competition.

The examination of rigidities strengthened the evaluation process, by better defining the duration and slope of any ramp-up period, as well as the underlying drivers of ramp-up.

Other rigidities that may emerge from the mapping process relate to environmental constraints or planning controls on the use of land at nodes, particularly for night time hours of operation of nodes. Where these constraints exist methods for dealing with them are required, and might include the need to use specific access/egress routes to nodes to reduce the impact on adjoining sensitive land-use.

C.6 Environmental and Social Costs, Benefits and Constraints

Shifts of truck trips and associated supply node operations to other time periods are likely to have a range of environmental impacts and social impacts, particularly if they are shifted to night time periods. These impacts include:

- reduced vehicle emissions, if there is reduced congestion and/or freight vehicle travel;
- an increased need for truck drivers and some supply node personnel to work over non-daytime shifts; and
- increased truck and freight terminal noise in night time periods, particularly where the terminals are in residential areas and/or trucks are required to travel through residential areas.

Estimates of the environmental changes were derived from strategic transport analyses, drawing on previous research by the study team.

Environmental Constraints

As indicated in Section C.1, environment protection orders are often used to prevent heavy vehicle operation in night time periods, and these can prevent the shift of freight deliveries to retail outlets from day to night periods.

Where protection orders are causing increased day-time truck operations, particularly in peak periods, it is appropriate consider the trade-off between congestion reduction and environmental constraint.

C.6.1 Specific Environmental Variables

The primary data and variables required for the environmental assessment are as follows.

Data

- Street directory map showing location of facilities, access route(s) from facility to arterial road network and land-use adjoining the facilities and access route(s) based on photos/notes of adjoining properties and along access routes (for example, residential, commercial, industrial, special uses, such as schools, hospitals).
- Conditions on the access routes in terms of grades and number of intersections where access vehicles may be required to stop (signals and signs where access route does not have priority), along with control of intersections.
- An estimate of existing background traffic on access roads by time of day, including proportion of heavy vehicles.
- Current and future staffing levels at facility and shift start/finish times (identified above as part of the node variables).

Variables

- Current and future terminal staff traffic generation (numbers and shift start/finish times)
- Land use mix adjoining facility
- Land use mix along access roads
- Length of access roads
- Number of signal controlled intersections on access route
- Number of intersections along access route where vehicle does not have priority
- Unit rate cost estimates from published data
- Average traffic speeds from network model with and without supply chain re-alignment
- Number of stops from network model with and without supply chain re-alignment

C.7 Estimating Industry and Freight Vehicle Travel Changes

The businesses and freight vehicles involved in the case study projects are a very small sample of the total businesses and vehicle fleets engaged in urban supply chains. Further, changes in freight vehicle trips, if they occur, could change the number and distribution of freight vehicle trips in several time periods. Thus, to ensure that the estimated impacts, costs and benefits from the Evaluation reflect the total business population and the urban freight travel system, the project used estimated freight vehicle trip matrices, by vehicle, class and time period of the work-week, in each city, to estimate impacts on freight and total vehicle travel over a work week and year.

For this ‘population expansion’ process to be applied it will be necessary that data on the industry classes for the participating businesses and the freight movements and vehicle schedules be collected during the mapping procedures.

Secondary data from previous studies, if available, that estimate the volume of containers by type of movement was used to provide a check on the above expansion process. The evaluation then used sensitivity tests to establish a range of benefits for industry as a whole, based on different rates of uptake of the re-alignments (for example, it is unlikely that all truck trips would divert from the AM peak, and if they did, then this would raise operational issues for transport operators).

C.7.1 Network Variables

The primary data sources and procedures relating to network variables are as follows.

Data sources

- Outputs from network models for the base and project cases for current and future years, in as much detail as the model can make available by road types, time period, purpose (private non-private) and vehicle class:
    - vkt and trips
    - travel time including delay time, number of stops,
    - average speeds.

- The reporting should be for both the whole urban network and the component of the network that is likely to be most affected by the re-alignment (eg., arterial roads).
- Unit values of traffic costs from published sources (e.g., RTA Economic Analysis Manual).

Network variables

- The variables, by time period for the base and project cases, both for whole network and impacted network, are:
    - Vehicle kilometres of travel by road stereotype and by vehicle class
    - Vehicle total travel time by class, by purpose (private/non-private) and delay time by class
    - Number of stops by class
    - Vehicle operating costs

C.8 Economic System Impacts

If the supply chain re-alignments cause significant changes in supply node and/or transport costs then it is likely that they will have flow-through (ie., multiplier) impacts on economic conditions in and beyond the Case study cities in future years. The business mapping procedures identified the industry(ies) in which the project businesses operate, and the set of industries from which the businesses source their input commodities (ie., upstream industries) and the set of industries to which they distribute commodities (ie., downstream industries).

Recent IMIS-MWT research indicated that it is possible to establish models to estimate the change in economic activity and value for a city, resulting from a change in the costs and/or outputs for a particular industry sector. The three primary forms of analysis are:

- input-output models, reflecting the economic flows between industry sectors;
- demand-price elasticities, reflecting the likely change in demand in a particular industry sector from price changes (ie., cost reductions) in upstream or downstream industry sectors; and
- GDP–Turnover relationships for particular industry sectors, reflecting the likely change in economic conditions in and beyond the city if cost reductions in a particular industry segment flow through to increased turnover in the particular industry segment.

A review of the application of input-output analyses to the evaluation of supply chain re-alignments indicates that, at this stage of their development, such analyses would not be appropriate for this Project. In additional to the procedural limitation of input-output analyses, the re-alignment projects are likely to result in relatively small changes to the economy, and thus require more detailed analysis procedures.

The review of procedures conducted during this Project has confirmed the continuing debate regarding the capacity of cost benefit analysis to fully account for the economic benefits of infrastructure improvements. This is due to a range of factors, including the nature of the cost-benefit procedure, which is a partial equilibrium approach. The review has also provided various estimates of cost benefit analysis's under-estimation of the full economic impacts of transport cost savings. These range between 1.4 and 2.0, with the range reflecting some uncertainty over the likely outcome. Consequently, for the purposes of this Project the range will be used to produce high and low estimates of these economic system impacts.

This evaluation procedure applied a low factor of 1.4 and a high factor of 2.0 to the savings of each supply chain re-alignment, net of private travel time cost savings. The result of this process will be an indicative range of likely increases in income due to the supply chain re-alignments. This provides a supporting measure of the economic impact of the project being evaluated, which should be considered in conjunction with the results of the cost benefit analysis.

C.8.1 Economic System Variables

The primary data and analysis procedures are as follows.

Data

- Outputs from cost benefit analysis and financial analysis.

Variables

- Multipliers – low (1.4) and high (2.0)
- Economic costs and benefit streams, disaggregated by vehicle operating costs, and travel time savings, disaggregated by vehicle class and purpose.

APPENDIX D EXTENDED CONTAINER PARK HOURS - MELBOURNE

This appendix contains supporting information for the assessment of the container park case study in Melbourne, considered in Sections 3.3.1 and 4.2 of the report.

D.1 Case Study Objectives and Primary Tasks

The objectives of this case study were to:

- determine to what extent trips which either arrive at or depart from the Chalmers Container Park (CCP) between 7:00am (when the park opens) and 9:00am weekdays, can be shifted to an alternative period, outside of peak traffic periods;
- estimate the costs and benefits to both the CCP and the participating transport company, Patrick Logistics (PL) (e.g., costs such as labour, plant & equipment resources, and benefits such as reduced trips, reduced trip times, etc); and
- extrapolate the potential shifts, costs and benefits for CCP and PL to the total container traffic population for metropolitan Melbourne and estimate the impact which these shifts will have on traffic congestion in the metropolitan road network, particularly in the Am peak period.

Primary Tasks for the Case Study

The primary case study tasks required to meet the above objectives were as follows.

- Estimation of current CCP costs and the likely changes resulting from extending hours.
- Generation of a profile of container receivals and the broad trip distribution, for PL and all other operators using CCP.
- Estimation of the likely shift in the PL profile and trip distribution, and the associated costs and benefits for PL, under an extended hour’s strategy.
- Extension of the estimates for PL to other transport operators using the CCP.
- Estimation of the likely impact on road congestion for the set of major roads which are involved in the container de-hire operations, providing confirmation or variation of the congestion reduction estimates from a preliminary assessment (Section 3.2.1).

D.2 Estimation of Container Park Costs Associated with Extended Hours

The CCP is located in Francis Street, Brooklyn (Figure D.1), approximately 6.1 km’s from the Port of Melbourne (Swanson and Appleton Docks, Figure 1) and is currently open on weekdays from 7:00am until 4:30pm. It is also open outside these hours and on Saturdays upon request at a cost per hour.

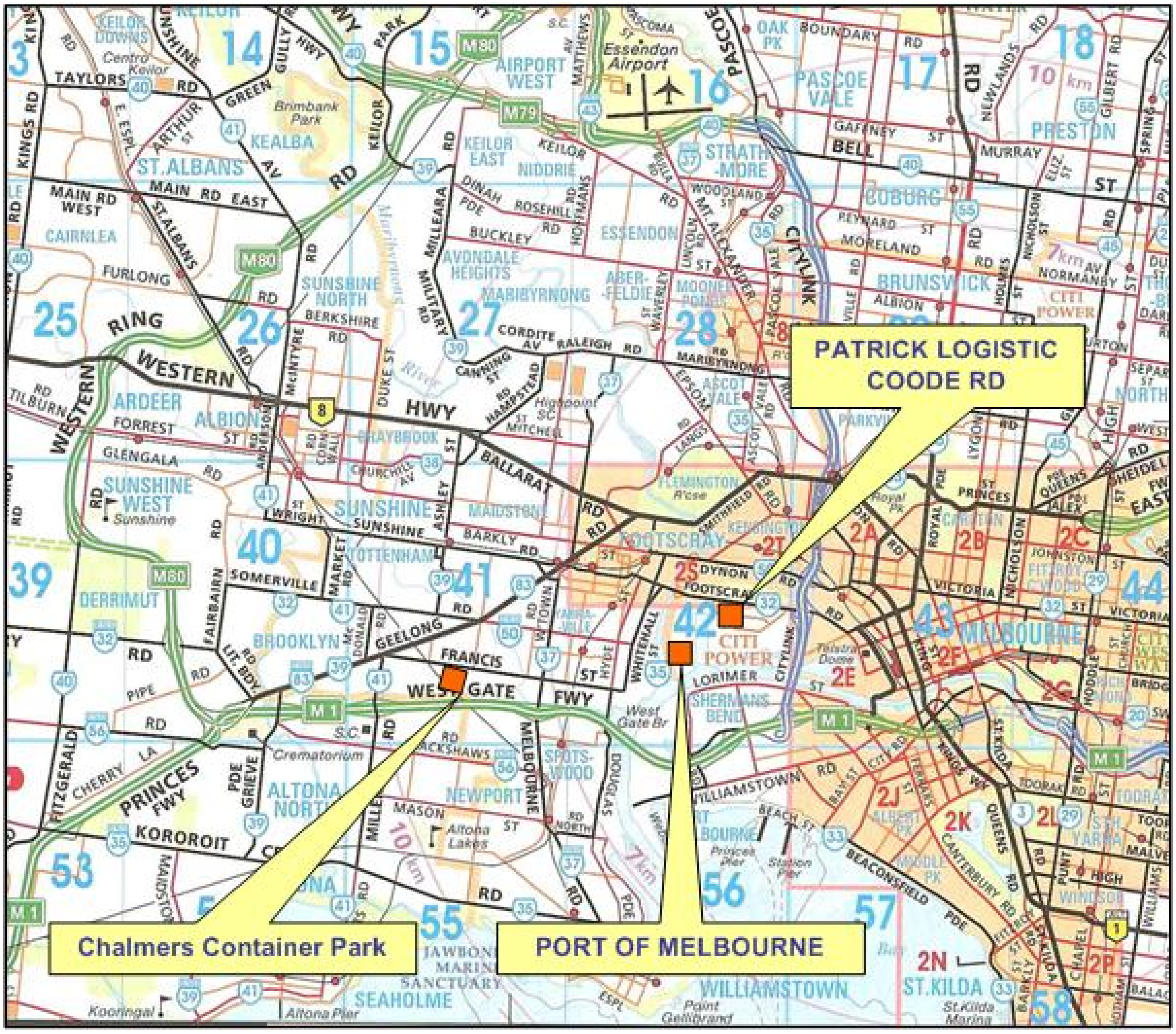


Figure D.1 Location of Chalmers Container Park and Patrick Logistics

For the purpose of the case study it was assumed that the CP opening hours could be extended from 4:30pm to 8:00pm on weekdays.

Three key processes were identified in the basic operations of the CP, which are necessary to support these extended hours, and these are:

- gatehouse and administration processes;
- container lift processes (forklifts); and
- container survey and inspection processes.

The costs associated with maintaining these processes if extended hours are implemented are detailed below under Labour and Plant & Equipment.

Appendix E shows the process maps for both inward (de-hire/importer) container movements, and outward (pick-up/exporter) movements. Each truck movement (i.e., either a pickup or drop off of a container at the CP) requires that the truck report to the gatehouse where it is directed to one of two processing locations. There is a processing location for 20 ft containers and similar for 40 foot containers. At these locations, the containers are:

- unloaded, inspected, and then stored, in the case of a de-hire (Figure D.2); or
- retrieved from storage and loaded, in the case of a pickup.

1. The fork lift is a Spreader Fork lift, capable of lifting 40ft and 20ft containers.

Figure D.2 A 40ft Container is Unloaded at the 40ft Inspection Point[1]

There are two primary identifiable costs associated with extending the container Park hours and these are labour and plant and equipment.

Labour Costs

The personnel required to support the extended hours include 1 gatehouse operator, 2 inspectors and 2 forklift drivers. It is necessary to have the equipment and personnel to handle 2 container moves simultaneously, due to the size of the park and the variable nature of arrivals of trucks for loading and unloading. Currently there is not a time-slot booking process, such as has been typically adopted by most Australian Stevedore. In addition, operationally, it is necessary to have multiple operators to ensure that customer service is provided in the event of illness, equipment breakdowns, unexpected high volumes of deliveries, etc.

For the case study, 8:00 pm was the nominated closing time because it coincides with a maximum allowable shift time of 14 hours. Frequently fork lift drivers commence work at 6:00 am daily and reach 14 hours by 8:00pm. In the event that the case study proves successful, and significant volumes of truck movements are attracted to the extended hours, it is likely that the park operators would consider split shifts for personnel, providing flexibility in closing times.

Table D.1 indicates the daily personnel cost associated with opening the CP for these additional 3.5 hours.

Table D.1 Daily Extended Hours Personnel Costs

Times	Hours	Total Cost per Hour	Number of Personnel	Total Cost
4:30pm to 6:00pm	1.5	$150	5	$225
6:00pm to 8:00pm	2.0	$225	5	$450
Total daily cost of extended hours				$675

Plant & Equipment Costs

Plant and equipment costs are associated with the provision of suitable lighting for inspection of containers in non-daylight hours. Currently the CP is not open beyond daylight hours and therefore does not have suitable lighting infrastructure to carry out inspections.

When a container is de-hired, an inspection is required prior to that container being stored. Containers are inspected underneath, externally and internally (Figure D.3). The inspection determines the seaworthy condition of the container. If the container is deemed seaworthy, it is stored and then available for the next assignment. If the container requires maintenance to make it is seaworthy, it is stored by the park in a location specifically for maintenance, which is undertaken by the park operations. Container maintenance occurs in all parks in volumes requiring permanent infrastructure and personnel resources and is a significant source of CP revenue.

Figure D.3 CCP Inspection of a 20ft Container Being de-hired off a B-Double

In order to implement the extended hours, it was assumed that suitable lighting is hired for the period of the case study. Table D.2 indicates the cost of hiring lights for the case study. Each bank of lights is hired for a minimum 5-day period.

Table D.2 Daily Extended Hours Plant and Equipment Costs

Lights required	Price per bank per 5 days	Price per 5 days	Price per day	Total for 20 days
6 Banks	$540	$3,240	$648	$12,960

As part of the cost analysis, the purchase of suitable lighting was reviewed and considered prohibitive. Second hand lighting was priced at $8K to $10K per bank of lights. This would however, become quickly cost effective given a permanent implementation.

CCP has indicated that the labour and plant & equipment costs detailed in Tables D.1 and D.2 are the only identifiable costs associated with extending the hours per the case study specification.

D.3 Container Receivals Profile and Trip Distribution, for Patrick and All Container Transport Operators

Port of Melbourne Total Container Traffic

The total Container throughput of the Port of Melbourne for the year ending May 2006 was 1.4 million units (POMC, 2006), including imports and exports of both empty and full containers, from and to coastal and international shipping.

CCP Container Traffic Profiles

Total container movements at CCP for the year ending May 2006 were 259K. These were a combination of 20 and 40 ft containers with a ratio of approximately 72% to 28% respectively. CCP therefore represents approximately 18% of the total population of container movements for that year. This 18% calculation presumes that every de-hire represents an import and every pick-up represents and export. However, it was realistic to assume that a % of these movements to and from CCP (not definable in this stage of the study) are regional or interstate and as such, this percentage was potentially over estimated in this stage of the assessment.

CCP provided a profile of container movements to and from the park for the period beginning June 05 and ending May 06. The raw data was provided by month and broken down into total movements in three-hour intervals over 24 hours, for each month. Table D.3 shows the annual total of each of the 3 hourly periods providing a daily profile of movements.

Table D.3 Total Annual Container Movements per 3-hour Period for CCP

00:00 - 02:59	3:00 - 05:59	6:00 - 8:59	9:00 - 11:59	12:00 - 14:59	15:00 - 17:59	18:00 - 20:59	21:00 - 23:59	Total
2403	456	50236 [1]	81050	80886	40834 [2]	1859	1124	258848
1%	0%	19%	31%	31%	16%	1%	0%	

1. The actual opening time of CCP is 7:00am, therefore, the majority of this volume is likely to be attributed to a 2-hour period being 7:00 to 9:00am.
2. The actual closing time of CCP is 4:30pm, therefore, the majority of this volume is likely to be attributed to a 1.5-hour period, being 3:00 to 4:30pm.

CCP management indicated that gate capacity is the key constraint for container throughput (i.e., the capacity for the administration to receive, process and direct each truck per the requirements of either the de-hire or pick-up activity). The current gate capacity was estimated at 125 movements per hour. The reported average hourly movements for the following time periods are:

- 7:00am to 9:00am - 209 movements (average per hour 104.5);
- 9:00am to 12:00pm – 338 movements (average per hour 112.6);
- 12:00pm to 3:00pm - 337 movements (average per hour 112.3); and
- 3:00pm to 4:30pm - 170 movements (average per hour 113).

This data shows a very flat hourly profile across an average day. These data indicate that the park is operating at approximately 90% of gate capacity on average which suggests, and is supported by feedback from park management, that the park frequently reaches gate capacity, resulting in truck queuing both inside and outside the park. This also suggests that there is limited ability to service new customers within the existing park hours.

It was assumed, based on annual stock takes of stored containers (see Table D.4), that there is a reasonably equal inward and outward flow of containers. This will vary seasonally, but was not considered likely to materially effect an implementation of extended hours, as the park is operating below storage capacity. The total storage capacity of the park is approximately 9K TEU.

Table D.4 Annual Stock Take of Stored Containers at CCP

Year Ending	Opening Stock TEU’s	Closing Stock TEU’s
June 05	5.9K	4.7K
June 06	4.7K	5.2K

From this data it might be concluded that growth in the business is constrained by current gate capacity and not by storage capacity.

Container Traffic Profiles for Patrick to CCP

Table D.5 shows the average volume of containers transported to and from CCP per month, for the period beginning Oct 2005 and ending Feb 2006, by Patrick Logistics.

Table D.5 Average Monthly Movements by Patrick Logistics at CCP

	Pick-ups	De-hires	Total Movements
Monthly Average	794	316	1110

If it is assumed that an average month has 20 working days, then the CCP daily profile (restricted to actual CCP operating hours) can be applied to the Patrick Logistics volume of 55 container movements per day (to CCP) and this is indicated in Table D.6.

Table D.6 Average 3 Hourly movements by Patrick Logistics to CCP per day

7:00 - 8:59	9:00 - 11:59	12:00 - 14:59	15:00 - 16:29	Total
11.38	17.37	17.34	9.39	55
21%	31%	31%	17%	

Of the average 11 to 12 movements made by PL daily between 7:00am and 9:00am, PL estimate that 90% of these trips are 'staged' de-hires. A 'staged' de-hire results when a PL delivery to a Container Park (e.g., CCP) is constrained by a mismatch of hours between the Container Park and a customer wishing to De-hire a container (e.g., a DC or exporter, etc.). A typical example of this mismatch or misalignment is a DC open to unload containers until later than 3.30pm will have containers available for transport and de-hire through to a designated hour (e.g., 6:00pm or 8:00pm). Containers ready for de-hire later than 4:00pm onward, assuming a minimum 30 minute travel time to a Container Park, will not make it to the Container Park before close. In order to satisfy customer requirements, the transport company will typically pick-up and transport the container back to the transport company depot for de-hiring the next day (see Figure D.4). It is considered highly desirable to reduce or eliminate these staged deliveries as the transport companies typically bare the cost of the staging, which includes 1 superfluous trip and the lift off and lift on of the container at the transport depot.

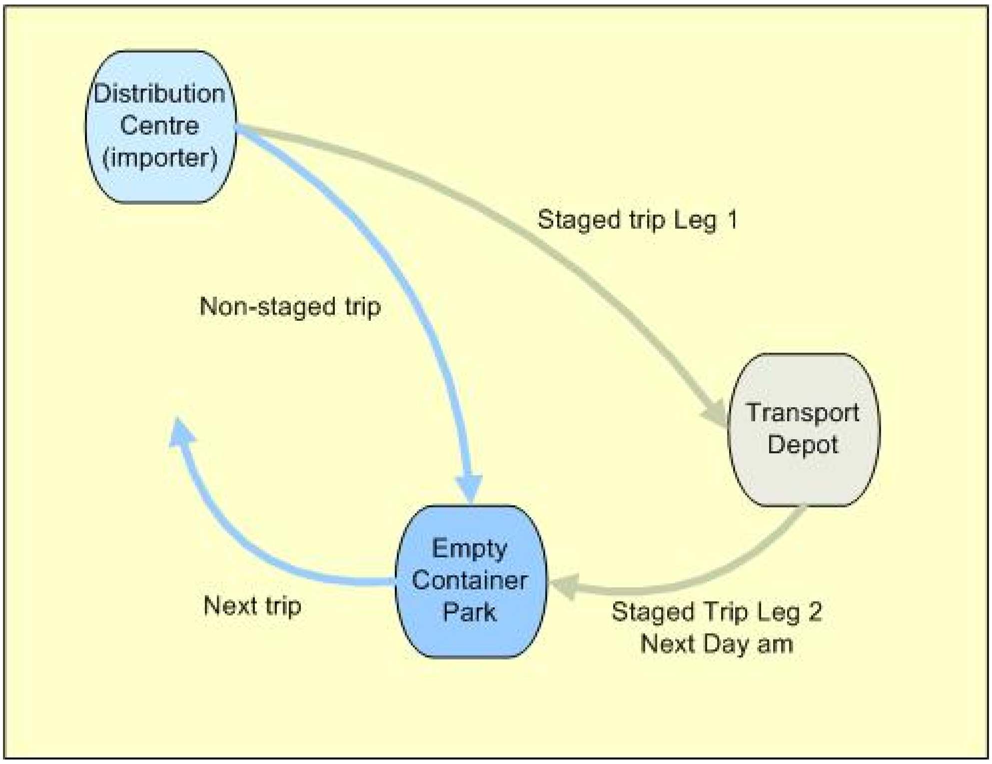


Figure D.4 Current De-hire Practise, Staged and Non-staged trips

D.4 Shift in Patrick Profile and Costs and Benefits under an Extended Hours Strategy

PL management indicated that the majority of all staged trips could and would be eliminated if the opportunity was provided through extending the CCP and other

Container Park hours. These staged trips represent a significant visible cost to the business as well as significant hidden costs associated with fleet utilisation.

Cost/Benefit of Shifted Trips Per Units

Table D.7 shows the cost and time difference between staged and non-staged trips when de-hiring containers.

Table D.7 Cost Comparison of Staged Versus Non Staged Trips to De-Hire Containers

Details		Non Staged	Staged Container Lifted	Variance	Staged Container *not* lifted	Variance
Trip from customer to CP or PL (= constant)	Mins	*X*	*X*	*0*	*X*	*0*
	Day	*X*	*X*	*0*	*X*	*0*
	$	*X*	*X*	*$ -*	*X*	*$ -*
Unload container with Fork Lift	Day		1			
	$		$ 20.00	*$ 20.00*		*$ -*
Load container with Fork Lift	Day		1 or 2			
	$		$ 20.00	*$ 20.00*		*$ -*
Travel to Container Park	Mins		20		20	
	Day		2		2	
	$		$ 30.00	*$ 30.00*	$ 30.00	*$ 30.00*
Estimated turnaround at CPP	Mins	45	60		60	
	Day	1	2		2	
	$	$ 67.50	$ 90.00	*$ 22.50*	$ 90.00	*$ 22.50*
Total Trip Cost Variation		**$ 67.50**	**$ 160.00**	*$ 92.50*	**$ 120.00**	*$ 52.50*

Note 1 –'Day' refers to the day on which the activity occurs.

The trips that will shift are predominantly staged de-hires, but also include Am peak period pickups. Currently, PL will send a truck to a Container Park to pick-up an empty container for export as its first load for the day, only to satisfy customer requirements. It is common that late notice is received regarding requirements for containers by exporters (i.e., mid to late afternoon for the next day), meaning that it is often not possible to schedule a truck and have it pick up the container before the Container Park closes. In the event that the CP hours were extended, PL could pick up these containers later in the evening as a 'stick-up'. 'Stick-up' is industry jargon for a load of freight that is loaded the night before in preparation for the next day's first load. This system is used to maximise utilisation of equipment (e.g., forklifts later in the afternoon) and to reduce the pressure on the same resources early morning as well as allowing trucks to leave the depot prior to and avoiding the Am peak period.

The savings relating to these Am peak pickups are equal to the saved turnaround time at the Container Park, (i.e., $22.50 per trip, Table D.7), as well as reduced travel time on the first load as they avoid the Am peak traffic delays. It is likely that significant reduction in time can be converted into either additional loads per day for each vehicle or reduced overtime costs. In this preliminary assessment it was not possible to estimate these additional benefits, but they will be mapped and quantified during the implementation stage of the case study.

As the majority of early morning trips by PL were deemed to be de-hires, the total savings per day calculated in the evaluation of these shifted trips is based entirely upon a combination of de-hires, being:

- 75% Staged Containers Lifted, with $92.50 savings per trip; and
- 25% Staged Containers Not Lifted, with $52.50 savings per trip.

Typically, transport company vehicles have a combination of lifted containers, stickups and dropped trailers. Dropped trailers allow a second trailer to be attached to maintain continuity of work in the existing or next shift. Stick ups and dropped trailers have a cost equal to the Staged Containers not Lifted cost in Table D.7.

When a truck returns to the depot for staging of a container de-hire before the end of a shift, the container is lifted when there is not a spare trailer, in the case of a company truck, and in all cases with contractors. Contractor trailers are not dropped as it is difficult to track these trailers and co-ordinate their return to the contractors' truck as there may be multiple locations for dropping trailers. These activities have a cost equal to the Staged Containers Lifted item in Table D.7.

Estimated PL Trips which will Shift

PL management have indicated that at least 75% of all staged trips will shift. Assuming that the current 12 trips indicated in Table D.8 are all de-hires, then, 9 of these will be moved to the extended hour's period 4:30pm to 8:00pm, changing the profile at CCP.

Table D.8 Estimated Shifted 'PL to CCP Trips', with Extended Hours

	7:00 - 8:59	9:00 - 11:59	12:00 - 14:59	15:00 – 16:29	16:30 – 20:00	Total
PL Current Deliveries to CCP	11.38	17.37	17.34	9.39	0	55
% of Total Trips	21.8%	30.9%	30.9%	16.3%	0%	
PL Estimated Trips to CCP with extended Hours	3	17	17	9	**9**	55
% of Total Trips	5.5%	30.9%	30.9%	16.3%	**16.3%**	

For the 9 trips which can shift, the cost savings will be:

- 75% Staged Containers Lifted, with $92.50 savings per trip; and
- 25% Staged Containers Not Lifted, with $52.50 savings per trip (based on advice from PL).

Then, the total savings will be:

Total daily savings for PL = (9 * 75% * $92.50) + (9 * 25% * $52.50) = $1,228

Estimated PL Trips which will Shift - Extrapolated to total CCP Population

CCP estimate that approximately 50% of their total customers would be able to shift hours from the Am peak period to the proposed extended hours 4:30pm to 8:00pm.

Table D.9 extrapolates the PL shift to the total CCP population, based on the 50% of customers able to shift.

Table D.9 Estimated Shift in 'All Carriers to CCP Trips', with Extended Hours

	7:00 - 8:59	9:00 - 11:59	12:00 - 14:59	15:00 – 16:29	16:30 – 20:00	Total
All Carriers Current Deliveries to CCP	209	338	337	170		1054
% of Total Trips	19.9%	32.0%	32.0%	16.1%		
Total Trips able to shift to extended hours (50% of total)	**104.5**	0	0	0	0	105
% of Total Trips	**10%**	0%	0%	0%	0%	
Final Profile for CCP Total Trips Actually Shifting (75% of all able trips)	131 [1]	338	337	170	**78** [2]	1054
% of Total Trips	12.4%	32.0%	32.0%	16.1%	**7.4%**	100%

1. Trips remaining in the 7:00 to 8:59 period under an extended hours scenario.
2. Trips shifting into the 16:30 to 20:00 period under an extended hours scenario.

The total savings will then be:

Total daily savings for total CPP population (including Patrick Logistics)
= (78 * 75% * $92.50) + (78 * 25% * $52.50) = $6,435

Estimated CCP Trips which will Shift - Extrapolated to Total Port of Melbourne Container Movement Population

Table D.10 shows the results of extrapolating the CCP volume shifts to the greater Melbourne Container movement population, given that extended hours were adopted across the Melbourne industry.

Table D.10 Estimated Daily Shift in 'All Carriers for total Port of Melbourne', with Extended Hours

	7:00 - 8:59	9:00 - 11:59	12:00 - 14:59	15:00 – 16:29	16:30 – 20:00	Total
Total Daily movements through Container Parks in Melbourne [3]	1156	1865	1862	940		5823
% of Total Trips	19.9%	32.0%	32.0%	16.1%	0%	
Total Trips able to shift to extended hours (50% of total)	**578**	0	0	0	0	578
% of Total Trips	**10%**	0%	0%	0%	0%	
Final Profile for Melb' Total Trips Actually Shifting (75% of all able trips)	723 [4]	1865	1862	940	**434** [5]	5823
% of Total Trips	**12%**	**32%**	**32%**	**16%**	**7%**	

3. Based on total number of import and export movements through Melbourne Ports.
4. Trips remaining in the 7:00 to 8:59 period under an extended hours scenario.

5. Trips shifting into the 16:30 to 20:00 period under an extended hours scenario.

The total savings will be:

Total daily savings for Melbourne = (434 X 75% X $92.50) + (434 X 25% X $52.50) = $35,805

Estimated total annual savings for Melbourne, including Chalmers CP = $35,805 X 20 X12 = $8.5m

Variations across Container Parks and Cities

It is likely that variations between Container Park operations and their customers in Melbourne and in other cities will have a material affect on how transferable the results from this case study will be to other parks. The addition of a second case study in Sydney (Appendix G) will confirm the level of transferability between cities and Container Parks.

D.5 Recommendation

It is recommended that this case study be undertaken as early as possible in October-November 2006.

REFERENCES

Port of Melbourne Corporation (2006). David Ross, Port Statistician

APPENDIX E RE-SCHEDULING OF LIQUOR DISTRIBUTION - MELBOURNE

This appendix contains supporting information for the assessment of the liquor distribution case study in Melbourne, considered in Sections 3.3.2 and 4.2 of the report.

E.1 Case Study Objectives and Primary Tasks

The objectives of this case study were to:
- determine to what extent trips which for liquor distribution to supermarkets in Melbourne in peak periods can be shifted to an alternative period, outside of peak traffic periods;
- estimate the costs and benefits to both the Spiral-Capital operations and the participating liquor retailers (e.g., costs such as labour, plant & equipment resources, and benefits such as reduced trips, reduced trip times, etc); and
- extrapolate the potential shifts, costs and benefits for Spiral-Capital and liquor retailers to the total liquor distribution for metropolitan Melbourne and estimate the impact which these shifts will have on traffic congestion in the metropolitan road network, particularly in the Am peak period.

Primary Tasks for the Case Study

As indicated in Section 3.3.2, Spiral-Capital agreed to participate in the case study, with the agreed primary tasks and outcomes being as follows.
- Identifying a sample of 3 vehicle runs which currently involve Am-peak operation in congested areas of Melbourne.
- Assessing the feasibility of advancing the run schedules prior to the Am-peak.
- Estimation of the likely reductions in travel time for the vehicles assigned to the runs.
- Estimation of the likely impacts, if any, on the Spiral fleet productivity and size.
- Assessment of the likely impacts on clients’ resources to enable the advanced delivery.
- Estimation of the likely impact on road congestion for the set of roads which are involved in the Spiral-Capital distribution operations.

The following sections:
- indicate the relevant aspects of the business location and operations;
- findings from the process mapping; and
- proposed case study.

E.2 Business Location and Current Operations

The Capital Distribution Centre (DC) is located at Clayton, in the South-east area of Melbourne. Orders are received in Melbourne for picking and assembly prior to loading. The loading operation is undertaken when the vehicle arrives and as the deliveries are predominately in single and multiple case lots, the orders are picked and palletised in a sequence that allows the first delivery on the pallet to be made without the need for the driver to re-arrange his load on the roadside.

Currently the majority of there vehicles are travelling to their first delivery location in the AM peak in order to meet the window for receiving specified by the individual business at the unloading location. There are other restrictions in some locations, particularly in strip shopping areas where there is a high incidence of tram and car commuter traffic at peak times

The focus of the mapping and case study development has been on the deliveries to businesses in the north-east of metropolitan Melbourne and in particular those deliveries that, if moved from current time slots in peak periods to other times, would reduce peak congestion and improve freight efficiency.

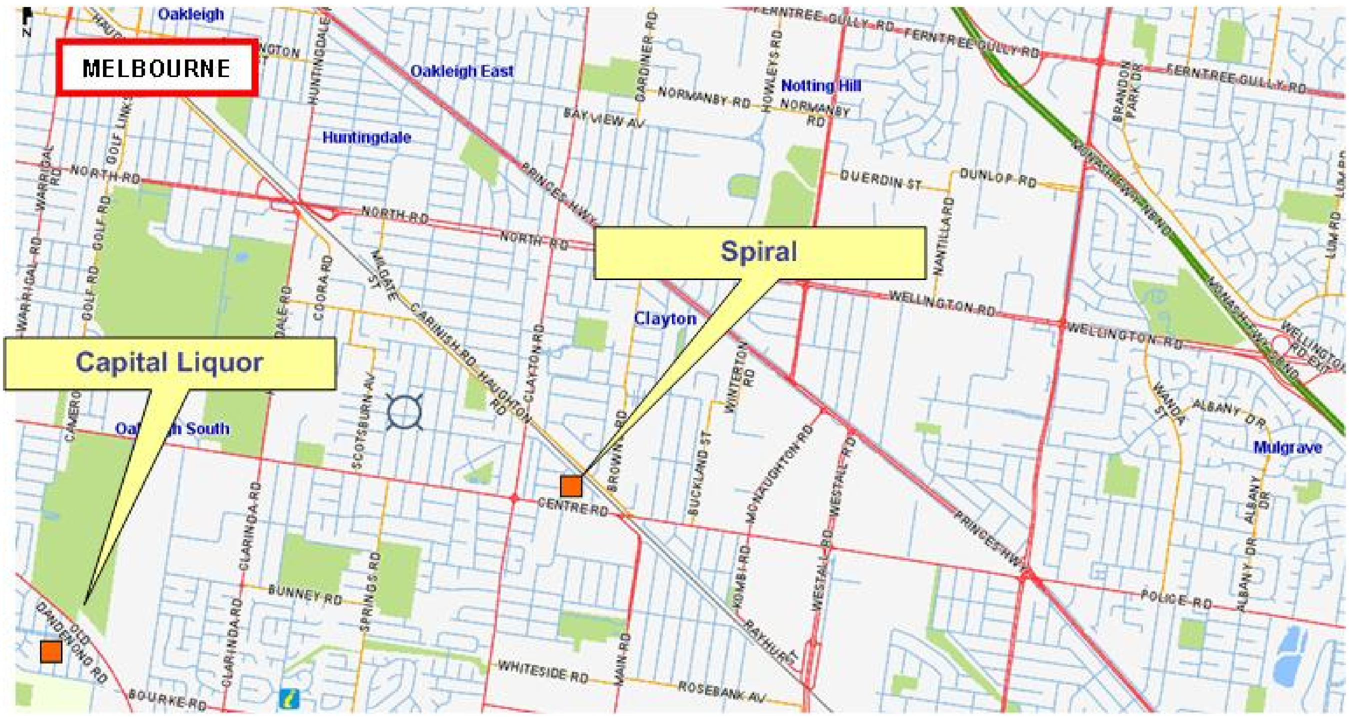


Figure E.1 Location of the Capital Liquor and Spiral Transport, Melbourne

E.2.1 Operational Issues

Delivery Issues

The deliveries are made to individual businesses, mostly located in shopping centres, strip shopping areas such as Chapel Street and close to residential housing. Many of these businesses have specified their delivery window from 9am or later which currently pushes the travel from the point of origin, which is Clayton, into the AM peak. A number of the vehicle delivery runs are then pushed towards and indeed into the PM peak. There are opportunities for the transport company to have a number of vehicles make more than one delivery run in a day, providing they can return to Clayton early enough to make a second delivery run.

Fleet Utilisation

The operation has 15 and a key focus is to move more of the first delivery runs ahead of or at the start of the AM peak as this will have a significant improvement in freight efficiency through higher utilisation of the fleet and ultimately a reduction in total truck numbers. The fleet ranges from a 2 tonne van to a 12tonne Tautliner. In simple terms, the time savings identified in this small sample has the potential to reduce the fleet by 2 vehicles with higher utilisation.

E.3 Process Mapping and Evaluation

The consultations regarding the above operational issues indicated that there is likely to be potential for both short-term and longer-term re-alignment of the liquor distribution operations, and it was agreed to focus the mapping and evaluation on the short-term re-alignment.

E.3.1 Short-Term Re-alignment

One of the key cost areas in metropolitan freight operations is labour cost. Currently this is incurring overtime for some vehicles but equally important is the inability to make a second delivery run with the same vehicle due the current arrival time back at Clayton after their first delivery run. It is highly desirable to reduce this overtime cost by starting the day shift vehicles earlier and moving some of the day shift deliveries onto the night shift operation. This will reduce congestion in the AM peak and the PM peak as well as reduce labour costs overall.

The extent of the change that is proposed is to have the delivery vehicles depart from Clayton at 7am which would require the delivery location to receive an hour earlier. In the spreadsheet of the driver’s daily runs, Option 3 is the one selected as the basis of the savings.

By starting the day earlier, the benefits are:

- Avoid AM peak which improves congestion
- Reduce overtime costs at the end of the day
- Avoid the PM peak which improves congestion
- Allows the vehicles to make a second delivery run, thus reducing the total fleet.

A map of the trips in the current operations is shown in Figure E.2. As this indicates, the journey for the first trip of the day occurs during the Am-peak. The return trip at the end of the day occurs during the Pm peak. Figure E.3 shows the impact and benefits of advancing the start of the daily operations by about 1 hour, without violating the council noise constraints. The mapping and evaluation therefore focussed on the impacts, costs and benefits of this potential shift in daily operations.

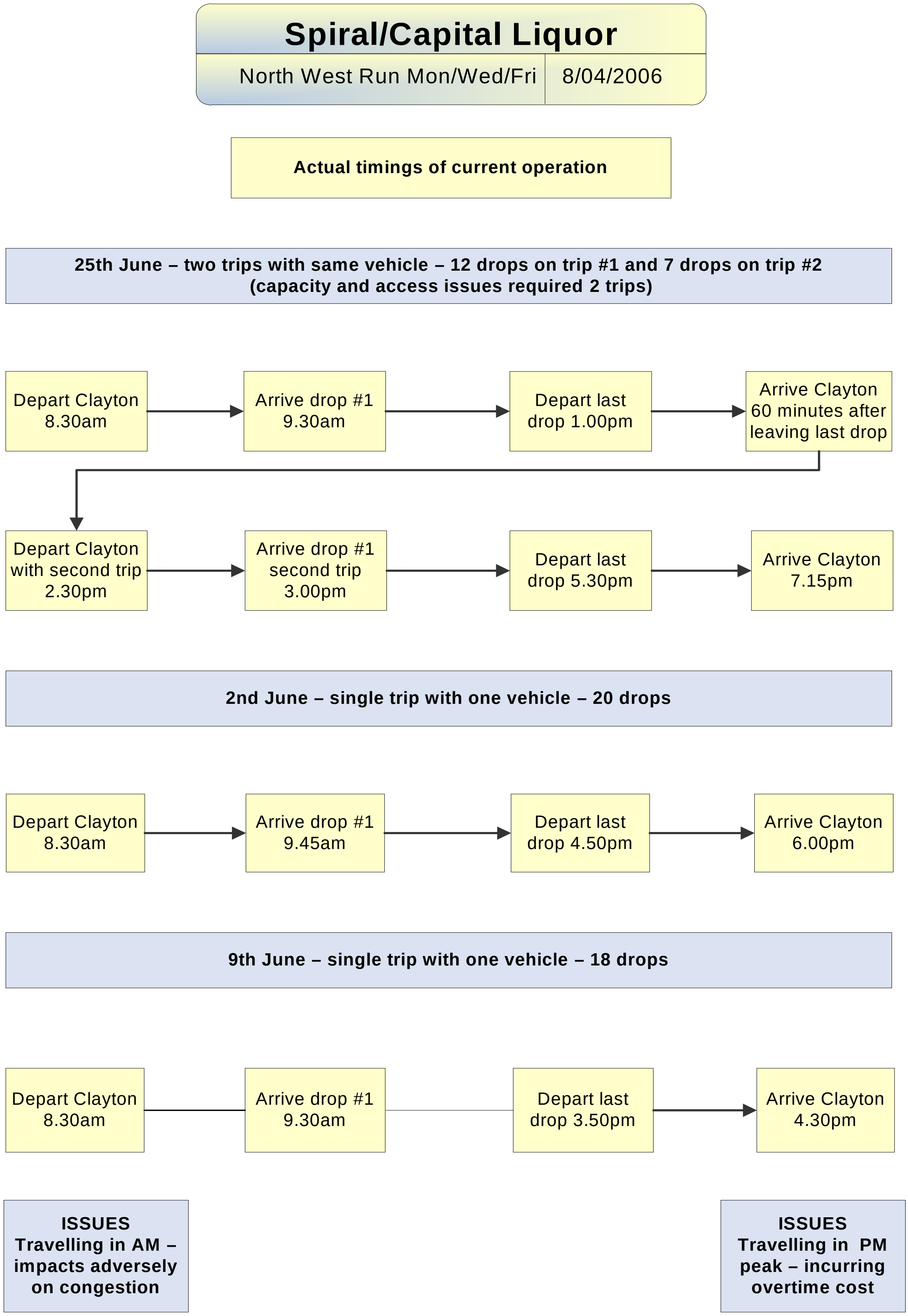


Figure E.2 Map of Current Day Time Liquor Distribution Operations

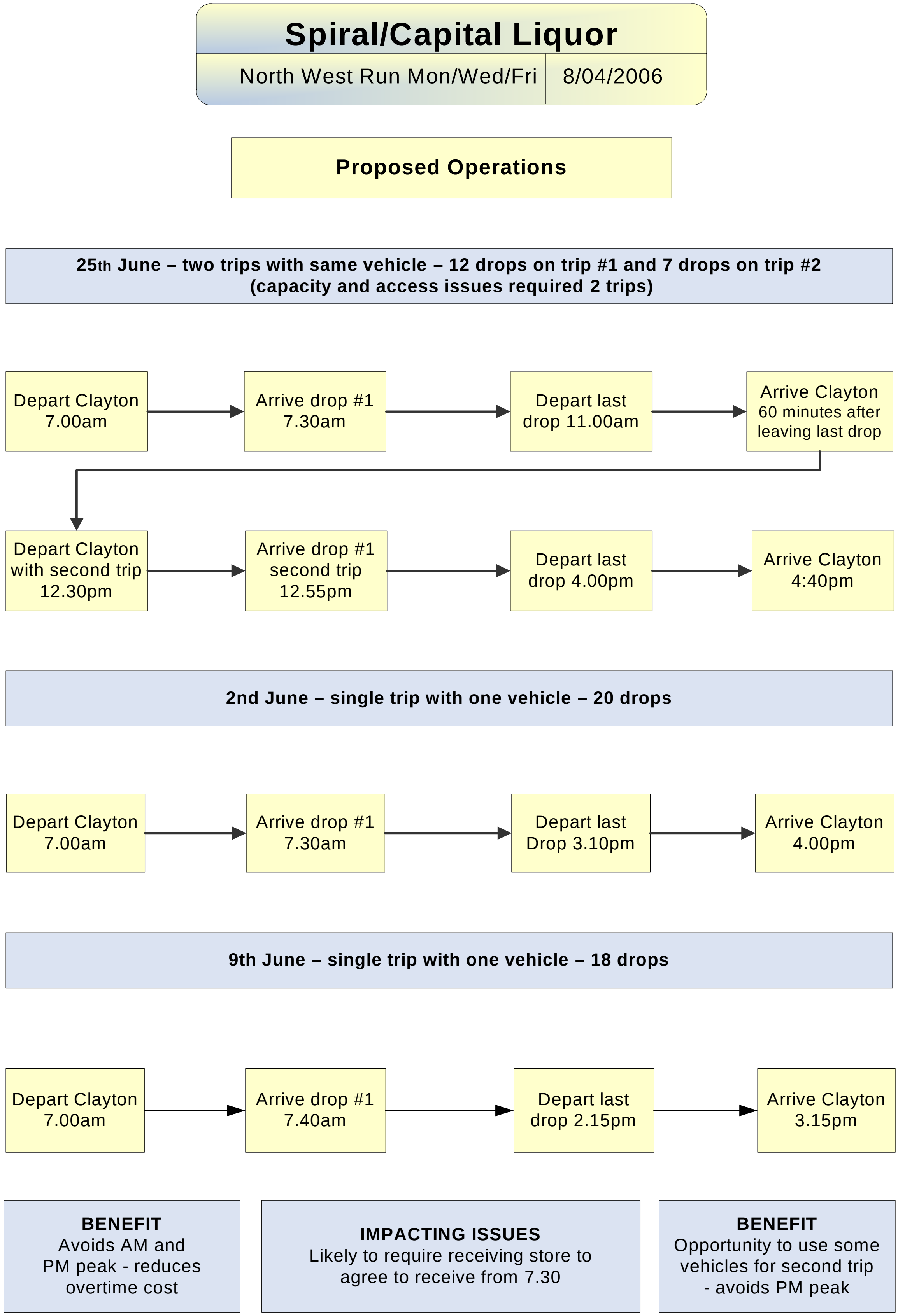


Figure E.3 Map of Proposed Liquor Distribution Operations

Savings

The estimated savings in labour cost (see spreadsheet) for the whole fleet is $918 per day which is $220,320 per annum. The fixed costs and operating costs remain unchanged as these vehicles will travel the same distance and the fixed costs will remain fixed.

Fleet Reduction Savings

The additional benefit of reducing the fleet by 2 vehicles would result in saving the fixed costs of these vehicles which is in the order of a further $50,000 per annum based on one small and one medium vehicle being removed from the fleet due to improved utilisation of the remainder of the fleet.

This fleet reduction will require the re-scheduling of the total fleet.

A total potential saving of $112,000 is possible which increases to $162,000 if the fleet can be reduced by 2 vehicles.

Impacts and Costs for Customers of Capital Liquor (Delivery Locations)

For the proposed trial there is potentially the impact of requiring the selected delivery locations to be able to receive their shipments at an earlier time. The cost impact on these delivery locations could be one hour of additional labour time which is estimated at $30 per location or $90 per day.

The cost impact for all delivery locations, if they are required to receive one hour earlier, is likely to be one hour of overtime for one person. Estimated cost to the receiving location would be approximately $30 and based on 15 stores opening earlier and incurring overtime this would be $450 per day or $108,000 per annum. This is probably a maximum estimated additional cost.

Cost Transfers

Cost benefits to the transport company are likely to be shared with the stores on a rebate for each occurrence or rate reduction.

E.3.2 Medium – Long term Re-alignment

The longer term objective is to move more as many vehicles as possible into a 7am (or earlier) start time which has the effect of potentially reducing total fleet numbers and as a consequence, improves freight efficiency, reduces freight costs and reduces truck numbers, in particular during the AM and PM peaks.

This will require a great deal of planning and potentially negotiations with the receiving locations to be in a position to receive deliveries earlier.

E.4 Proposed Case Study

We have identified a number of metropolitan runs that appear to be suitable to run a trial by bringing the start time for the day shift forward. The outcomes of a trial would be that we can prove and quantify the following:

- Reduction in labour costs
- Reduction in numbers of trips in the AM peak for first delivery operations
- Avoids the PM peak
- Allowing a number of vehicles to make a second delivery run
- Improvements vehicle utilisation and freight efficiency

E.5 Recommendation

It is recommended that this case study be undertaken as early as possible in October-November 2006.

APPENDIX F RE-SCHEDULING OF COLD FOOD DISTRIBUTION - BRISBANE

This appendix contains supporting information for the assessment of the cold food distribution case study in Brisbane, considered in Sections 3.3.3 and 4.2 of the report.

F.1 Case Study Objectives and Primary Tasks

The objectives of this case study were to:

- determine to what extent trips which for cold food distribution to supermarkets in Brisbane in peak periods can be shifted to an alternative period, outside of peak traffic periods;
- estimate the costs and benefits to both the Swire-Frigmobile operations and the participating food retailers (e.g., costs such as labour, plant & equipment resources, and benefits such as reduced trips, reduced trip times, etc); and
- extrapolate the potential shifts, costs and benefits for Swire and food retailer to the total cold food distribution for metropolitan Brisbane and estimate the impact which these shifts will have on traffic congestion in the metropolitan road network, particularly in the Am peak period.

Primary Tasks for the Case Study

As indicated in Section 3.3.3, Swire-Frigmobile agreed to participate in the case study, with the agreed primary tasks and outcomes being as follows.

- Identifying a sample of 5 vehicle runs which currently involve Am-peak operation in congested areas of Brisbane.
- Assessing the feasibility of advancing the run schedules prior to the Am-peak.
- Estimation of the likely reductions in travel time for the vehicles assigned to the runs.
- Estimation of the likely impacts, if any, on the Frigmobile fleet productivity and size.
- Assessment of the likely impacts on clients' resources to enable the advanced delivery.
- Estimation of the likely impact on road congestion for the set of roads which are involved in the Swire-Frigmobile distribution operations.

The following sections:

- indicate the relevant aspects of the business location and operations;
- findings from the process mapping; and
- proposed case study.

F.2 Business Location and Current Operations

The Distribution Centre (DC) is located at Cannon Hill, immediately to the south of the Gateway Bridge and this operates 24 hours a day. Orders are received centrally in Melbourne and the Brisbane orders transmitted to the DC for picking and assembly prior to loading. The loading operation is primarily one that pre-loads trailers using yard tugs to position trailers. This reduces the time at the DC for drivers as they hook up their trailer ready for the next delivery run.

Currently there are approximately 25% of the metropolitan loads that are crossing the Brisbane River for locations north west of the city during the AM peak period. Deliveries to the south are generally running against the AM peak traffic and therefore the peak is having little impact. Deliveries north over the Gateway Bridge are scheduled to depart prior to the AM peak to avoid delays due to AM peak congestion.

The operation has the delivery of fresh, frozen and chilled food products to supermarkets for a major food retailer, as its core business. The deliveries in this operation extend from North Queensland to Northern New South Wales.

The focus of the mapping and case study development has been on the deliveries to metropolitan Brisbane and in particular those deliveries that, if moved from current time slots in peak periods to other times, would reduce peak congestion and improve freight efficiency.

Figure F.1 Location of the Swire DC, Brisbane

F.2.1 Operational Issues

Delivery Issues

A number of the supermarkets have delivery restrictions imposed on them by local councils due to the proximity of the supermarket to residential housing and furthermore there are store delivery windows for each supermarket. The store delivery windows are able to be considered for a change and our initial approach is to work within the existing council restrictions although in the longer term there is likely to be a trade off between congestion reduction and noise outside of the currently permissible hours for delivery.

Fleet Utilisation

The operation has 33 vehicles of which 16 are used on night shift which runs from 6pm until 5am. A key focus is to move more of the day shift deliveries into the night shift as this will have a significant improvement in freight efficiency through higher utilisation of the fleet and ultimately a reduction in total truck numbers. In simple terms, for every full days work for a vehicle that can be moved from day shift to night shift, there is a saving of one vehicle. Each vehicle costs approximately $130,000 pa in total operating costs.

In addition this would have the benefit of removing a vehicle from the network during day time operations thus reducing congestion.

F.3 Process Mapping and Evaluation

The consultations regarding the above operational issues indicated that there is likely to be potential for both short-term and longer-term re-alignment of the cold food distribution operations, and it was agreed to focus the mapping and evaluation on the short-term re-alignment.

F.3.1 Short-Term Re-alignment

One of the key cost areas in metropolitan freight operations is labour cost. Currently this operation is experiencing a relatively high overtime cost as the day shift drivers are generally working between 11 and 12 hours per day. It is highly desirable to reduce this overtime cost by starting the day shift vehicles earlier and moving some of the day shift deliveries onto the night shift operation. This will reduce congestion in the AM peak and reduce labour costs overall.

The current 11 to 12 hour day for day shift also impacts on the night shift operation as many of the trucks used on day shift are not back until late in the afternoon, typically between 1600 and 1800. This means that the night shift operations cannot commence until the trucks have finished the day shift work and puts the first run for the night shift drivers into the PM peak.

By starting the day shift earlier, the benefits are:

- Avoid AM peak which improves congestion
- Reduce overtime costs on day shift
- Ensures that he vehicles are available earlier for the night shift
- Allows the night shift first runs to avoid the PM peak, which improves congestion

A map of the trips in the current operations is shown in Figure F.2. As this indicates, there are a number of journeys for which the first trip of the day occurs during the Am-peak. The figure also shows that it is possible advance the star of the daily operations by about 1 hour, without violating the council noise constraints. The mapping and evaluation therefore focussed on the impacts, costs and benefits of this potential shift in daily operations.

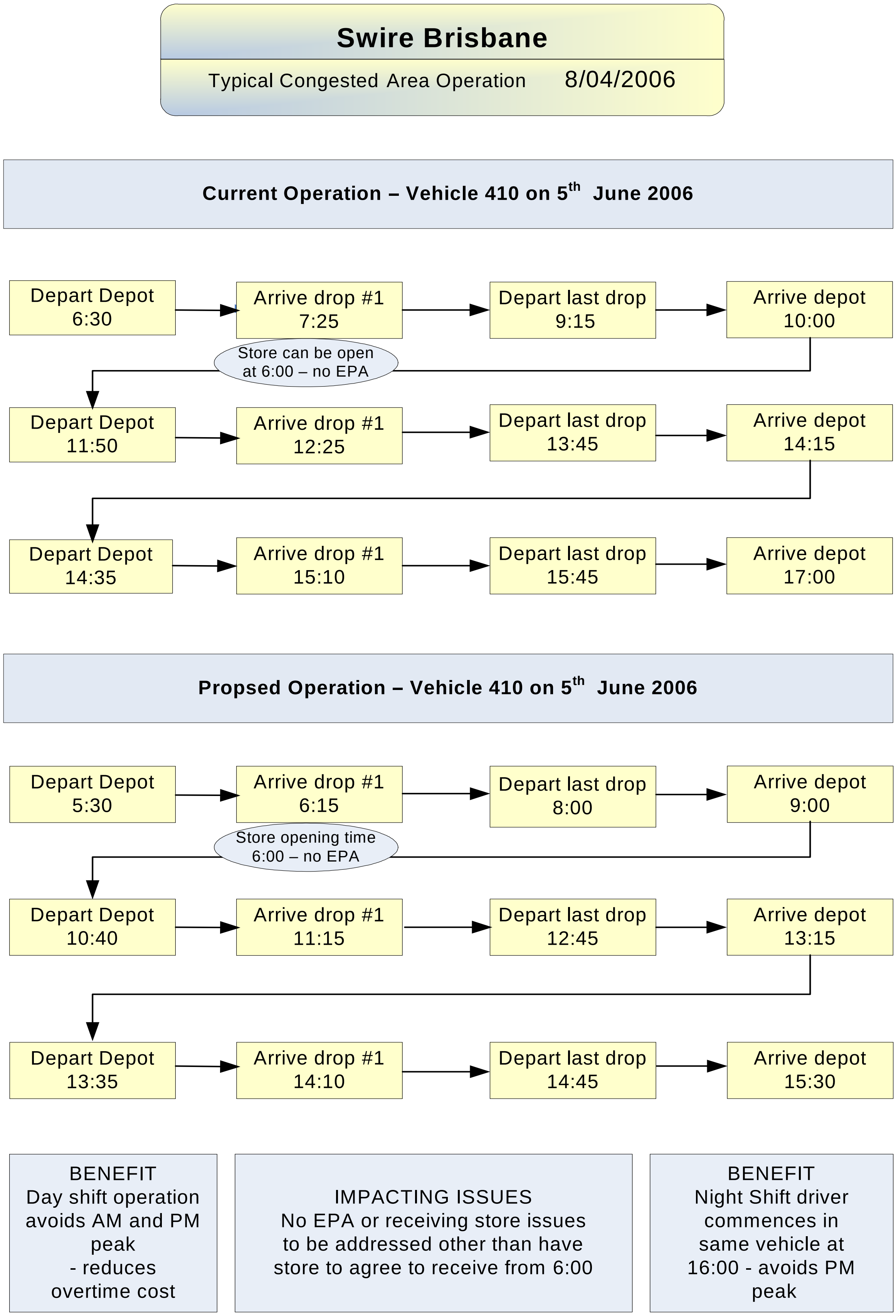


Figure F.2 Map of Current & Proposed Food Distribution Operations

Day Shift Savings

The estimated savings in labour cost (see spreadsheet) is $3926 per day which is $702,336 per annum. The fixed costs and operating costs remain unchanged as these vehicles will trave the same distance and the fixed costs will remain fixed.

Night Shift Savings

The impact of starting the night shift prior to the PM peak, which is only possible if the day shift drivers finish earlier (see comments above and spreadsheet), is estimated to save 8 hours per day for the night shift fleet which has an estimated labour cost saving of $400 per day, an annual potential saving of a further $95,000 per annum.

A total potential saving of $797,000 is possible.

Impacts and Costs for Retailer Stores

For the proposed trial there appears to be little or no impact on the stores selected in the deliveries for the trial. The store opening hours for each of them is 0600, this needs to be confirmed as the operational practices may have replaced the stated opening times for the stores.

The cost impact for other stores, if they are required to receive one hour earlier, is likely to be one hour of overtime for one person. Estimated cost to the store would be approximately $40 and based on 10 stores opening earlier and incurring overtime this would be $400 per day or $96,000 per annum. This is probably a maximum estimated additional cost.

Cost Transfers

Cost benefits to the transport company are likely to be shared with the stores on a rebate for each occurrence or rate reduction.

F.3.2 Medium – Long term Re-alignment

The longer term objective is to move more of the day shift workload onto the night shift which has the effect of reducing total fleet numbers and as a consequence, improves freight efficiency, reduces freight costs and reduces truck numbers during the day and in particular during the AM and PM peaks.

This will require a great deal of planning and potentially negotiations with the Retailer to have individual supermarkets change their delivery windows. It will also require the issue of local council delivery restrictions to be addressed.

F.4 Proposed Case Study

We have identified a number of metropolitan runs that appear to be suitable to run a trial by bringing the start time for the day shift forward. The outcomes of a trial would be that we can prove and quantify the following:

- Reduction in day shift labour costs
- Reduction in numbers of trips in the AM peak for day shift operations
- Allowing the night shift to start earlier which reduces the number of night shift trips starting in the PM peak
- Improvements vehicle utilisation and freight efficiency

The permanent shift from day shift deliveries to night shift deliveries appears to be possible in approximately 30% of the delivery locations without any requirement to adjust and local EPA restrictions related to noise from hight time deliveries.

A further 30% would be possible if there were minor adjustments to existing EPA restrictions.

F.5 Recommendation

It is recommended that this case study be undertaken as early as possible in October-November 2000.

APPENDIX G EXTENDED CONTAINER PARK HOURS - SYDNEY

This appendix contains supporting information for the assessment of the container park case study in Sydney, considered in Sections 3.3.4 and 4.2 of the report.

G.1 Case Study Objectives and Primary Tasks

The objectives of this case study were to:

- Determine to what extent inbound trips can be shifted to alternative periods; primarily outside of peak traffic periods and secondarily outside of business hours for those trips which either arrive at or depart from the P&O Container Park (POCP) between 6:00am (opening time) and 5:00pm (closing time) weekdays.
- Estimate the potential costs and benefits in shifting trips to alternative periods for both the POCP and the participating transport company, VISA Australia Pty Ltd (VISA).
- Extrapolate the potential shifts, costs and benefits for POCP and VISA to the total container traffic population for metropolitan Sydney and estimate the impact which these shifts will have on traffic congestion in the metropolitan road network, particularly in the AM peak period.

Primary Tasks for the Case Study

The primary case study tasks required to meet the above objectives were as follows;

- Record and document a profile of container movements, for VISA and build an overall Movement Profile that includes other operators using POCP.
- Estimation of current POCP costs and the likely changes resulting from extending hours.
- Estimation of the likely shift in the VISA trip distribution and the associated costs and benefits for VISA, under an extended hours strategy.
- Extension of the estimates for VISA to other transport operators using the POCP.
- Estimation of the likely impact on road congestion for the set of major roads that are used to travel to/from POCP
- Provide confirmation of or variation to the congestion reduction estimates for the preliminary assessment (Section 3.2.1).

G.2 Container Park Costs Associated with Extended Hours

The POCP is located in Botany Road, Port Botany (Figure G.1), immediately East of P&O Ports and is currently open on weekdays from 6:00am until 5:00pm. It is also open outside these normal operating hours both on weekdays and on Saturdays upon request at a cost per hour.

Figure G.1 Location of P&O Container Park and VISA Australia

For the purpose of the case study it was assumed that the POCP opening hours could be extended from 5:00pm to 8:00pm on weekdays.

There are 3 key processes identified in the operations of the POCP that are necessary to support extended hours. These are consistent with the findings from the Melbourne CP study (Appendix D) and are the:

- Gatehouse and administration processes.
- Container lift processes (forklifts); and
- Container survey and inspection processes.

The costs associated with maintaining these processes, if extended hours are implemented, are detailed below under Labour and Plant & Equipment.

General information

This container park has a rail siding. The majority of rail movements are outward empty containers and primarily bound for NSW regional destinations such as the North West Slopes and Plains,(e.g Narrabri), and Central West Slopes and Plains (e.g. Dubbo). These areas produce export commodities including cotton, pet foods, flour and gluten products etc.

Figure G.2 P&O Container Park Rail Siding with Empty containers bound for regional NSW

Currently POCP regularly opens after hours for ‘stack runs’(road vehicles) of empty containers through to the port, upon request by shipping lines. A stack run refers to the transport of a number of empty containers of a specific brand to the port typically for relocation to international locations. Many of these containers are those requiring minor repair works. It has become common practice to undertake these repairs offshore due to lower maintenance costs It was indicated that approximately 50% of all import containers require maintenance as identified at the point of de-hire. These stack runs are evidenced by the data supplied by POCP, with periodic movements of between 20 and 50 containers (at a rate of 10 to 15 containers per hour) typically commencing at around 6:00pm and occasionally continuing all night for larger runs.

The POCP caters for a greater number of services than that of the Melbourne study park. At this park services include:

- Maintenance and repair of containers (typical of the majority of empty container parks).
- Steam cleaning of general containers in order to make them ready for food carriage (contamination on general containers may include seeds, dirt, wet oil spillage etc).
- ISO Tank Repairs. ISO tanks (see Figure G.3) carry oils e.g. lubricants, vegetable and peanut oils, resins and alcohol. Repairing and cleaning these tanks is a specialist activity requiring high pressure steam and water equipment and stringent confined space safety procedures for internal inspections.
- Receipt, pack/unpack of loaded containers, primarily of large tires for the mining quarrying industries.

Figure G.3 P&O Container Park - Stacking ISO Tanks

Figure G.4 P&O Container Park - Imported Mine/Quarry Vehicle Tyres

There are two primary identifiable costs associated with extending the container Park hours and these are labour and plant and equipment.

Labour Costs

There is a larger number of staff employed at this Container Park than that of the Melbourne study. This is to cater for the additional activities undertaken at the park. The staff includes:

Admin and management Staff	5
Supervision Staff	4
Container control Clerks	4
Forklift drivers	11
Rank Inspectors	2
Surveyors	3
Maintenance Repairs Clerks	2
Repairs & Maintenance Staff	6
Wash bay Staff	5
ISO Tank repair staff	2
Rail Staff	3
Pack/Unpack facilities	2

The personnel required to support the extended hours include 3 Container Control staff, 2 Rank Inspectors and 3 forklift drivers. As is the case with the Melbourne case study, it is necessary to have the staff to support significant volumes of movements, although it is conceivable that the staff may not be fully utilised in the 'ramp up'[1] period. It is important to note that the number of staff required to support the extended hours is similar in both Sydney and Melbourne, although marginally higher in Sydney. There is commonality in the activities and the resources required to support these activities and as such it is reasonable to indicate a significant level of transferability between container parks within and across Australian cities.

In order to review the container case studies with a level of consistency between cities and parks, it was decided to use 8:00 pm as the nominated closing time for the extended hours for POCP (as was the case in Melbourne).

Note 1: 'Ramp up' refers to a period of growth in activity preceding a settled pattern of activity, typically occurring after an implementation of a new or significantly altered activity.

Table G.1 indicates the daily personnel cost associated with opening the CP for these additional 3.0 hours.

Table G.1 Daily Extended Hours Personnel Costs

Times	Hours	Cost per Hour	Number & Description of Personnel	Total Cost

5:00pm to 8:00pm	3.0	$47	3 Forklift drivers	$423
5:00pm to 8:00pm	3.0	$37	3 Container Control Staff	$333
5:00pm to 8:00pm	3.0	$37	2 Rank Inspectors	$222
Total daily cost of extended hours				$978

Plant & Equipment Costs

As was the case with the Melbourne case study, plant and equipment costs are associated with the provision of suitable lighting for inspection of containers in non-daylight hours. Currently the POCP is not open normally beyond daylight hours and therefore does not have suitable lighting infrastructure to carry out inspections. However, it was noted during the Sydney study that the available hours naturally extend during the summer months and that this, combined with daylight savings, provides adequate light to carry out normal duties from 6:00am to 7:30/8:00pm daily. It is therefore conceivable that extended hours could be implemented, in the first instance, during summer months or gradually as daylight hours extend, with no additional capital cost to the park, and that this would:

- Coincide with the seasonal growth in container movements in the lead up to the Christmas period; and
- Adequately service a ramp up period until critical volumes of movements are achieved and the new pattern of daily movement is established to the extent that capital investment can be financially justified.

For the purpose of this case study, it was considered that the cost to either hire or purchase suitable lighting to cater for an extended hours implementation would be consistent with Melbourne and as such the same financials are quoted for Sydney.

Table G.2 indicates the monthly cost associated with providing adequate lighting for inspection of containers at the CP for these additional 3.0 hours.

Table G.2 Daily Extended Hours Plant and Equipment Costs

Lights required	Price per bank per 5 days	Price per 5 days	Price per day	Total for 20 days
6 Banks	$540	$3,240	$648	$12,960

A purchase of suitable lighting for the case study implementation was reviewed and considered prohibitive. Second hand lighting was priced at $8K to $10K per bank of lights. This would however, become quickly cost effective given a permanent implementation .

POCP has indicated that the labour and plant & equipment costs detailed in Tables G.1 and G.2 are the only identifiable costs associated with extending the hours per the case study specification.

G.3 Container Receivals Profile and Trip Distribution for VISA and All Container Transport Operators

Sydney Ports Total Container Traffic

The total Container throughput of Port Botany for the year ending June 2006 was 1.01 million units (SPC, 2006), including imports and exports of both empty and full containers, from and to coastal and international shipping.

The total number of imports for the year ending June 2006 was 0.518 million units.

POCP Container Traffic Profiles

Total container movements at POCP for the year ending Jun 2006 was 173K. These were a combination of 20 and 40 ft containers and included full and empty containers as well as rail movements.

Given the majority if not all containers will eventually move through a Container Park then;

- POCP represents approximately 17% of the total population of container movements for that year.
- This 17% presumes that every de-hire represents an import and every pick-up represents an export.

It is also realistic to assume that an additional % of movements to and from POCP (not definable in this stage of the study) originate from regional or interstate and as such, this 17 percentage is potentially under estimated at this stage of the assessment.

POCP provided a profile of container movements to and from the park for the period beginning Jan 05 and ending Jul 06. The raw data was provided by month and broken down into total movements in one-hour intervals over 24 hours, for each month. Table G.3 shows the total of each of the 1hourly periods throughout a normal work day, with hours outside normal workday hours grouped.

Table G.3 Total Container Movements (18 months ending Jul 06) per Period for POCP

0-6	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-20	20-24	Total
3662	22426	26916	25771	24193	26221	26029	24637	24348	23419	21054	15313	5901	2989	272879
1%	8%	10%	9%	9%	10%	10%	9%	9%	9%	8%	6%	2%	1%	100%

POCP management indicated that processing capacity is reached frequently during the lunchtime period (i.e., the capacity for the administration to receive, process and direct each truck per the requirements of either the de-hire or pick-up activity). Although staff breaks are taken during this period, every endeavour is made to maximize the resources available for processing containers.

- The park reaching processing capacity results in queuing on Port Botany Rd.

It was indicated that until recently, the queuing has occurred with no enforcement of regulation. It is now common for trucks to be penalized by traffic authorities for parking on Port Botany Rd and as such alternative arrangements must be considered by the transport companies.

- The alternative is likely to included shifting delivery/pickup times to/from the POCP by either rearranging up and downstream node arrival departure times, or staging trips via transport depots.

Additional research would be required to verify that this is in-fact resulting in staged trips (i.e. adding additional trips into the supply chain), and or spreading of trips.

- The spreading of trips out of the lunchtime capacity constraint period is likely to push trips into the PM road traffic peak period, as this time slot(s) is where the park currently appears to have capacity.

- There are no facilities for booking delivery/pick-up timeslots at this or other container parks, as there are at the port, and as such arrivals of vehicles at the park are difficult to forecast for the POCP itself.

- Turnaround times and queuing are also difficult for the transport companies to forecast and as such optimisation of transport fleets is compromised.

Transport companies are typically left with little alternative regarding deliveries as they are constrained by a number of factors.

- Shipping lines own or lease the containers and as such are ultimately responsible for paying charges associated with load/unload and storage at empty CP’s. As a result they are typically contractually bound to specific CP’s.
- Importers and exporters make a contract with a shipping line for the international transport of their goods. They are then directed by the shipping lines with regard to the location of containers at the point of de-hire.
- Transport companies are contracted to the importers and exporters for the land-based transport of containers and are directed in regards to de’hire by the importers and exporters.
- The majority of all shipping lines direct their containers to be stored at one location. This is likely to enhance purchasing power and to facilitate operational efficiencies, e.g having containers in one location facilitates stack runs. One noted exception in Sydney is ANL which allows de-hire at several parks in Sydney.

Figures G.5 and G.6 show the contractual relationships between parties in the import container supply chain as well as the impact of staging trips which may occur as a result of the mismatch of hours between nodes in the supply chain or other constraints as mentioned above.

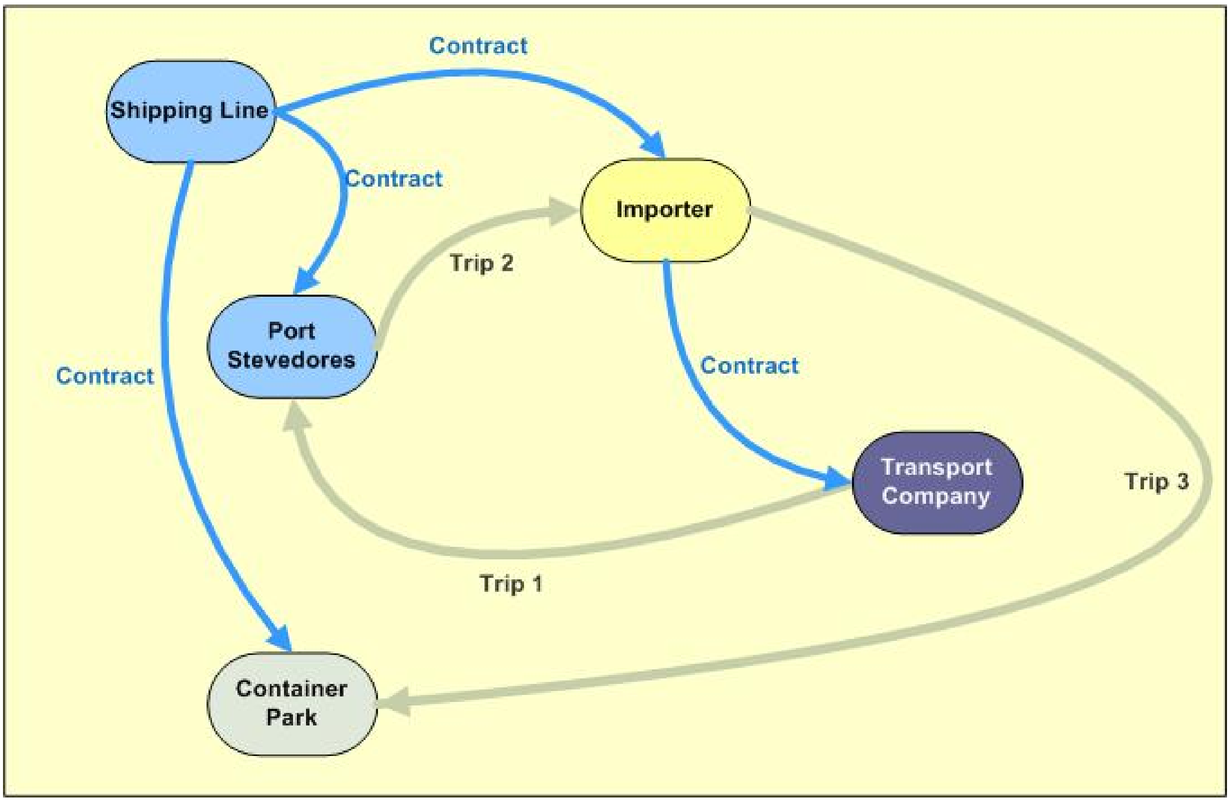


Figure G.5 Import Container Supply Chain – No Staging

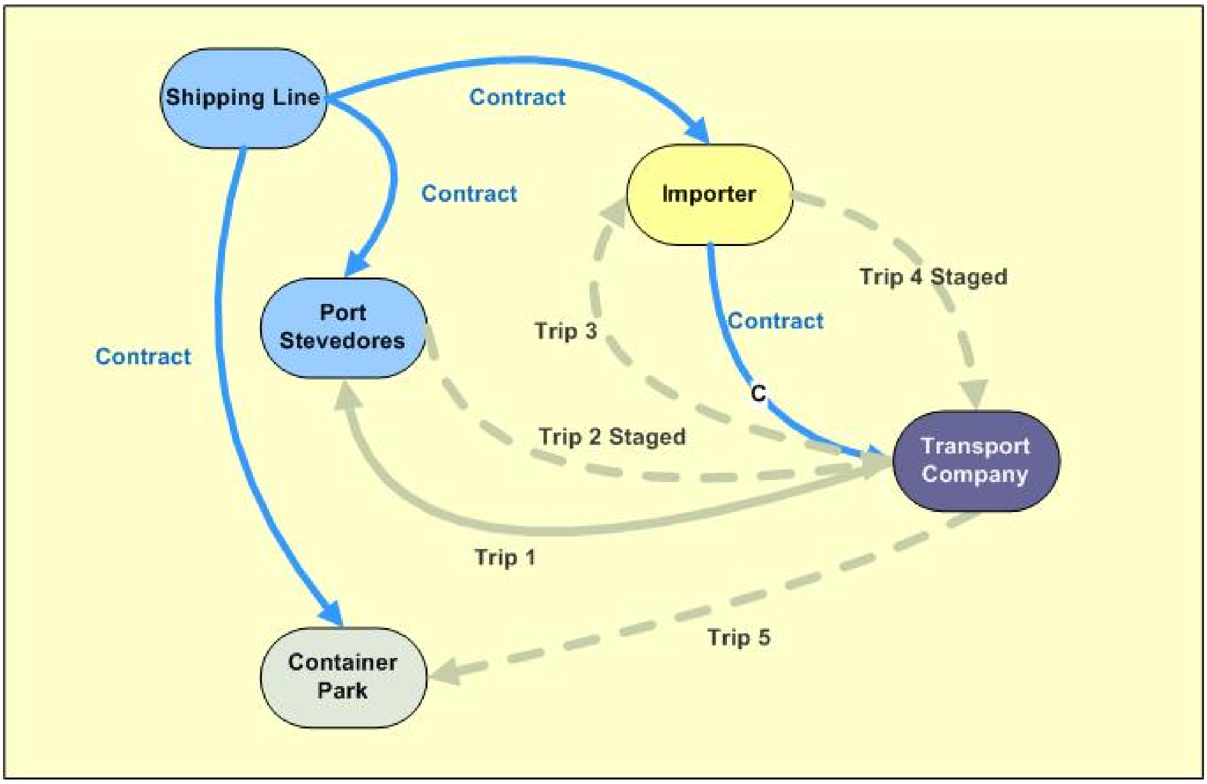


Figure G.6 Import Container Supply Chain – Maximum Staging

The average Daily movements at the park by time slot, based on the 12 months ending June 06 are as follows.

Table G.4 Average Daily Movements by Time Slot for POCP

0-6	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-20	20-24	Total
10	53	62	57	55	61	60	58	56	55	49	35	13	8	**633**
1.6%	8.3%	9.8%	9.0%	8.7%	9.6%	9.5%	9.2%	8.8%	8.7%	7.8%	5.5%	2.1%	1.2%	**100%**

This data shows a very flat hourly profile across an average day. POCP indicated that they typically reach capacity around the lunch period and given that volumes are consistent across an average day, then it is reasonable to assume that the park is operating close to processing capacity across the normal working day.

Although stock figures were not available for this case study, it is assumed, based on annual stock that there is a reasonably equal inward and outward flow of containers.

VISA Australia

Business Details

VISA is a national 3rd Party Logistics provider. In Sydney they a have a Distribution Centre and road transport service. They are located in Friendship rd Port botany, see Figure G1.

Their road transport fleet consists of:

- 16 prime movers;
- 1 four tonne rigid; and
- 1 eight tonne rigid.

In order to maximize utilization and to cater for varying customer needs, they have a large fleet of trailers which includes:

- 15 - Roll Back trailers
- 13 - Retractable trailers
- 3 - 20 ft Bogie Skel trailers
- 5 - 40ft Bogie Skel trailers
- 3 - Flat top trailers
- 14 - Tri Axle Skel trailers
- 2 - Side Lifters
- 3 - 40ft Tautliners
- 1 - 20ft Tautliner

It is important to understand the make-up of this fleet and the reasons for it's configuration to be able to appreciate the opportunities that may be recognizable from extending container park hours. For example;

- Roll back and Retractable trailers offer the operator the ability to carry several different configurations of container size combinations on a B-Double truck combination. These trailers allow a B-Double "A" trailer to be used not only when a container is going to be lifted off a trailer by a forklift, but when a trailer needs to backed into a loading dock for loading or unloading whilst the trailer is connected to the vehicle. Typically, there is an undercarriage assembly which supports the pivoting point of the B trailer that extends beyond where the load finishes on the A trailer and this prevents unloading at the rear whilst the container is on the trailer. The roll back trailer allows the container to roll back to the rear of the trailer for unloading, Figure G.7.

- Retractable trailers allow wheel carriage assemblies to be retracted under a trailer for similar purposes.

This is important information as it has the potential to create significant efficiencies in the supply chain and even to eliminate trips.

- Particular B-Double trailer combinations may require a trailer to be lifted and left for unloading at a node, requiring a return trip to pick up the empty container, whereas retractable and rollback trailers offer the opportunity to unload whilst the vehicle waits, thus eliminating a trip.

No attempt has been made to quantify this potential within the current study, however, it is recommended that this opportunity is tabled for further consideration.

Figure G.7 Roll-back B-Double 'A' trailer with 20ft Container in Rolled Back Position

At the time of this study, VISA indicated they were not de-hiring many containers to POCP. This is because their current customer base is using shipping lines which do not have contractual arrangements with POCP (as discussed above). There most common de-hire location is MCS, located at either Cooks River, or Banksmeadow, see Figure G.10.

- However, the sea freight link in the container supply chain is highly dynamic and importers/exporters can frequently change shipping lines. As such a transport company may see a change in its de-hire activity (in relation to location) with the next import.

In addition, VISA indicated that they were staging very few trips prior to de-hiring containers. Further discussion with VISA indicated that there were other opportunities for efficiencies within their system that would translate into a shift in timing of trips and these are discussed in below.

Opportunities for change

Visa moves between 30 and 50 containers per day. These movements can be divided into 3 main categories relating to the manner in which they are loaded/unloaded and these are described by VISA as:

- Side Loaders;
- Driver waits; and
- Drop Trailers.

Side Loaders

This refers to deliveries where containers are unloaded at a site by trucks with side loading crane equipment on the trailers. As these trailers have a crane located at the rear of the vehicle, it is not possible to unload the container whilst it is on the trailer (due to the doors being located at the rear of the container). For sites where there is no fork lift equipment and the container is likely to take some hours to unpack, then these trailers are very efficient as they enable the transporter to drop the container and complete additional trips with the trailer before returning for the pick up.

Driver waits

This refers to deliveries where the transporters vehicle, with trailer, remains at the customer site whilst the container is unloaded. This is particularly common when the freight can be quickly unloaded, such as palletized goods and/or when there are no facilities to unload a container.

Drop trailers

This refers to deliveries where the trailer with container is left at the customer site. Commonly it is located in a loading bay ready for load/unload. Often a second trailer may have been left at the site earlier and this is then removed from the site together with an empty container for de-hire, by the transporter, which creates efficiencies (i.e. eliminates dead-runs).

Shifts

Currently, VISA runs 2 driver shifts:

- a day shift which ends at 6:00pm;
- and a second shift commencing at 6:00pm.

The second shift is a minimum paid 8 hours but is frequently significantly underutilized.

Currently it is extremely difficult to book time slots at the port to pick up loaded containers other than outside of normal business hours. P&O runs a booking system where carriers are able to pay an annual premium ($30K) to be given 4 guaranteed time slots at the port per hour, during these premium business hours. VISA along with approximately 30 other carriers have taken this option and these companies are known as 'B' carriers. Time slots which are not booked by VISA are made available to other 'B' carriers, prior to becoming available to general carriers.

Even having taken up the option to become a 'B' carrier through necessity, VISA sees significant efficiencies in taking night time slots at the port, and this activity is undertaken by the 2nd shift. VISA has arrangements with a number of customers to make deliveries and pickups after hours, i.e. they have security access to customers yards where they can drop trailers and pick up trailers. Currently, If they drop a loaded container either on or off a trailer at a customer yard during the night period, they are unable to pick up an empty container without staging the trip via their depot. If they were to stage the trip via their depot, they would need to make at least one additional trip the next day to clear that trailer for other use.

If the container park hours could be extended, VISA indicates that they would be able to drop full containers later into the day at their customer and then de-hire an empty on a return trip. This is currently not happening as they actively avoid staged trips due to restricted storage space at their facility. VISA also indicates that given that this change is made, that this would lead to either:

- Significant cost savings resulting from reducing the number of vehicles and staff required to undertake their current freight task; or
- The ability to take on new additional work.

Either option will deliver improvements to the efficiency and profit of VISA and other transport carriers in a similar position, whilst reducing the total number of trips required to undertake the current freight task and providing opportunities to undertake part of the forecast growth of the total freight task in off peak, out of business hours.

There are numerous configurations for tours of a container which passes through the port as an import and ends upon de-hire at a container park. Figures G.8 and G.9 below are just 2.

- It is these two tours upon which the carrier financials and network trip savings quoted in Table G.5 are based. However, it should be noted that these may vary between and within individual carriers operations.

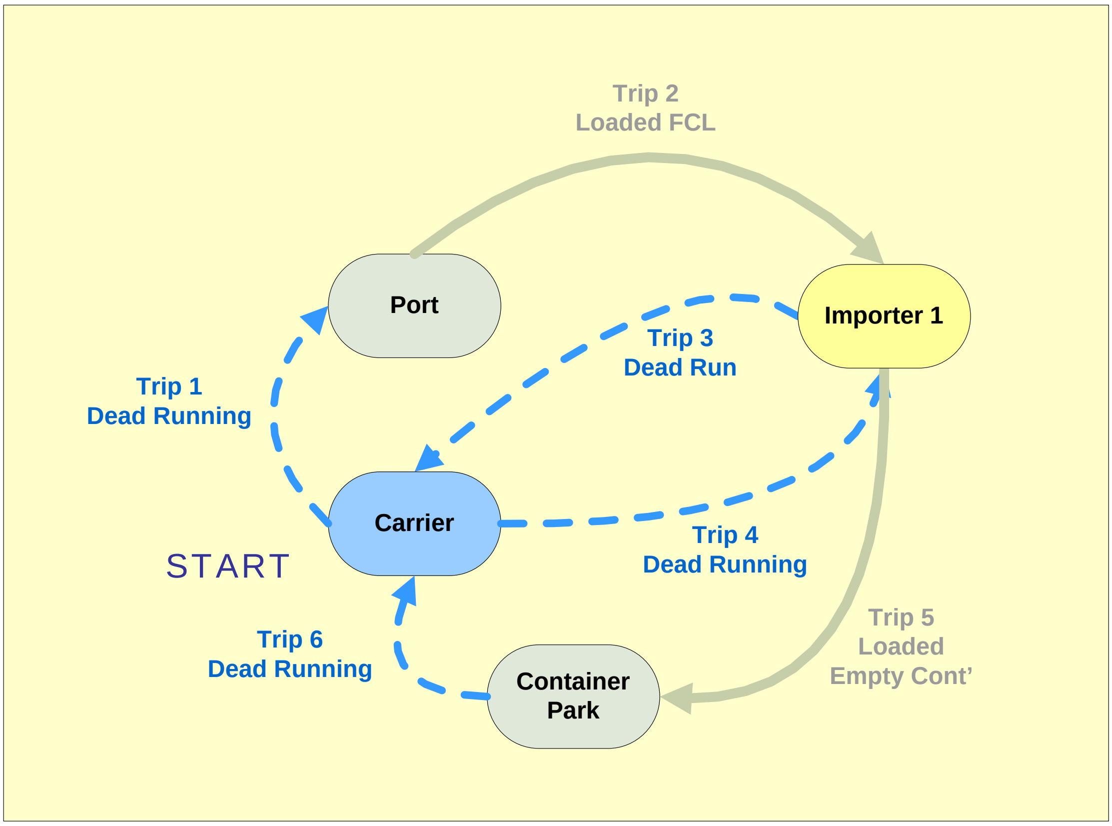


Figure G.8 Port to Container Park – Container Tour, Scenario 1

Figure G.8 above shows a tour where trips 3 and 4 could be eliminated if an immediate de-hire was possible as demonstrated in figure G.9, rather than dropping a trailer and returning at a later time. It is likely that additional trips may be made between Trips 3 and 4 in Figure G.8, however, it is equally probable that a dead-run trip will be made in many cases in returning to pick up the empty container. For the purpose of this case study it is assumed that drop trailer trips made later in the afternoon are subject to the constraint associated with the misalignment of hours between the container park and the carriers customer. The financials presented in Table G.5 below are based upon this assumption.

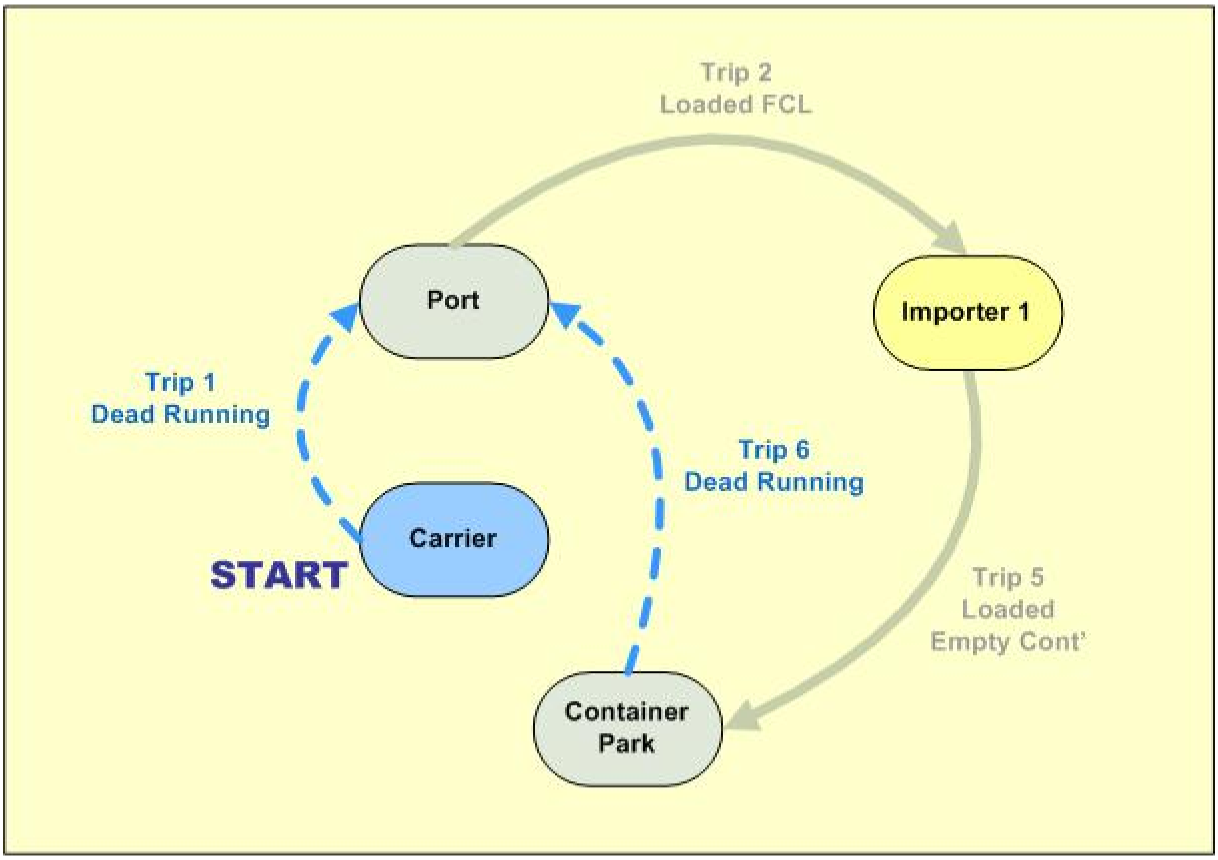


Figure G.9 Port to Container Park – Container Tour, Scenario 2

Table G.5 VISA Daily Capital Savings

Trip Types		
Side Loaders	Container based trips per day	12
Driver Waits	Container based trips per day	14
Drop Trailers	Container based trips per day	18
Assume	'Drop Trailers' Most likely to deliver reduced trips	
Assume	Approximately 1/3 of Prime movers doing 'Drop Trailers'	
Assume	Each of these trucks could dehire one container between 17:00and 20:00	5
Assume	Dead Run Trips Saved per truck (see figure G8 & G9)	2
	Total Trips Saved per day	10
Assume	Total Time per Trip to Moorebank from Port Botany or return in mins	45
	Total time savings per day in minutes	450
	Total time savings per day in hours	7.5
	Running cost per hour for a semi trailer	$ 90.00
	Total running cost savings per day	**$ 675.00**
	Capital Savings	
Estimated	Prime Mover and Semi Trailer purchase price	$ 300,000
Estimated	Written Down Value at year 5 end	$ 100,000
	Total Cost over 5 years	$ 200,000
	Annual cost	$ 40,000
	Total Work Days based on 5.5 day week	277
	Daily cost	**$ 144.40**
	Total Daily Savings capital and running	**$ 819.40**

Annual days	365
Public Hols	10
Sundays	52
Saturdays @ .5	26
Total Work days	**277**

Financials and assumptions

- Trips associated with drop trailers are most likely to yield opportunities for change, as these are the trips where the carrier can potentially leave the customer site with a dead-run trip.
- Approximately 1/3 of the VISA fleet will be engaged in drop trailer activity at any one time as the number of containers transported daily in each of the 3 trip types is almost equal.
- There are 16 prime movers so approximately 5 will be engaged in drop trailer activity.
- The savings in trips are represented by the shift in trip patterns between those demonstrated in Figures G.8 and G.9
- A trip to Moorebank has been deemed an average trip in length and time for the purpose of developing a case study that is transferable to the greater

population of container moves. As such, costs and savings are based on this trip.

- The running cost per hour for a semi trailer is based upon an understanding of the industry average, and has been considered and endorsed by transport carriers associated with this and the Melbourne case study.
- The scenario used in this case study assumes that the carrier will reduce fleet to maintain current freight task rather than increase total freight task with new work. It is however quite conceivable that carriers would take the opportunity created by the time freed up each day to procure new custom.
- Given that approximately 7.5 carrier hours per day are freed up under the extended hours scenario, the carrier has suggested they are likely to divest at least one vehicle from the fleet. The daily capital savings are presented in table G.5 below.

Estimated VISA Trips which will Shift

Based on the assumptions outlined above, 5 trips per day will move from within the current daytime periods (i.e. 6:00 to 17:00) into the evening period 17:00 to 20:00.

The total POCP current container de-hire profile indicated in Table G.6 was derived by taking POCP total container movements (table G.4), subtracting any Saturday and Sunday movements, dividing by the number of recorded weekdays, and multiplying by 50% (assume that there is typically a balance of inward and outward movements and that the majority of all inward movements are de-hires).

Table G.6 POCP Current Container De-Hire daily Profile

0-6	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-20	20-24	Total
5	26	31	28	27	31	30	29	28	28	25	17	7	4	**317**
1.6%	8.3%	9.8%	9.0%	8.7%	9.6%	9.5%	9.2%	8.8%	8.7%	7.8%	5.5%	2.1%	1.2%	**100%**

Note: The profile includes the grouping of hours Midnight until 6:00am, 17:00 to 20:00 (target extended hours), 20:00 to 24:00. All other periods are one hour. This is the same for all tables X to X.

The VISA Current Container De-hire Daily Profile, Table G.7 is based upon 40 containers de-hired daily (as indicated by VISA). There was insufficient data available to develop a daily profile pattern and as such it is assumed, for this case study that these de-hires are evenly spread throughout the working day. As indicated above, currently very few of these containers are being de-hired into the POCP. However, for the purpose of this case study, profiles have been developed on the basis that these 40 are de-hired into POCP. The impacts from shifted and eliminated trips is likely to be reasonably constant regardless of the CP they are de-hired into, as the majority of all CP activity occurs within the Port Botany precinct. See Figure G.10 below.

Table G.7 VISA Current Container De-Hire daily Profile

0-6	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-20	20-24	Total
0	3.5	4.1	3.8	3.6	4.0	4.0	3.9	3.7	3.7	3.3	2.4	0	0	**40**
0.0%	8.8%	10.3%	9.4%	9.1%	10.1%	10.0%	9.7%	9.3%	9.2%	8.3%	5.9%	0.0%	0.0%	**100%**

The VISA Shifted Container De-Hire daily Profile, Table G.8, reflects the 5 trips that can be shifted as indicated in Table G.5. For the purpose of this case study, the 5 shifting trips have been moved from each time slot by an equal factor of 5/11, where 11 is the total hours across the 6:00 to 17:00.

Table G.8 VISA Shifted Container De-Hire daily Profile

0-6	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-20	20-24	Total
0	3.1	3.6	3.3	3.2	3.6	3.5	3.4	3.3	3.2	2.8	1.9	5.0	0	**40**
0.0%	7.6%	9.1%	8.3%	8.0%	9.0%	8.8%	8.5%	8.2%	8.0%	7.1%	4.8%	12.5%	0.0%	**100%**

Estimated VISA Trips which will Shift - Extrapolated to total POCP Population

The POCP shifted daily container profile, Table G.9, reflects the revised %'s calculated in Table G.8, with allowance for activity which is already occurring outside of the hours 6:00 to 17:00. This shift results in 46 trips moving out of the normal work hours period into the extended hours period daily.

Table G.9 POCP Shifted Container De-Hire daily Profile

0-6	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-20	20-24	Total
5	23	27	25	24	27	27	26	24	24	21	14	46	4	**317**
1.6%	7.2%	8.7%	7.8%	7.5%	8.5%	8.4%	8.1%	7.7%	7.6%	6.7%	4.4%	14.6%	1.2%	**100%**

Estimated POCP Trips which will Shift - Extrapolated to total Sydney Population

The Total Sydney Current Container De-Hire - Daily Profile, Table G.10, has been estimated by applying the POCP current daily Container de-hire profile hourly %'s, Table G.9, to the total Sydney annual weekday De-hires divided by the number of weekdays. De-hires have been assumed to be equal to total imports.

Table G.10 Total Sydney Current Container De-Hire - Daily Profile

0-6	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-20	20-24	Total
32	165	195	178	172	192	189	183	176	173	155	109	42	25	**1985**
1.6%	8.3%	9.8%	9.0%	8.7%	9.6%	9.5%	9.2%	8.8%	8.7%	7.8%	5.5%	2.1%	1.2%	**100%**

The Total Sydney Shifted Container De-Hire - Daily Profile, Table G.11, has been estimated by applying the POCP Shifted Daily Container de-hire profile hourly %'s, Table G.9, to the total Sydney annual weekday De-hires divided by the number of weekdays.

Table G.11 Total Sydney Shifted Container De-Hire - Daily Profile

0-6	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-20	20-24	Total
32	143	172	155	149	169	167	161	153	151	132	87	290	25	**1985**
1.6%	7.2%	8.7%	7.8%	7.5%	8.5%	8.4%	8.1%	7.7%	7.6%	6.7%	4.4%	14.6%	1.2%	**100%**

The Total Sydney Current Container De-Hire - Annual Profile, Table G.11, has been estimated by applying the POCP Current Container De-Hire daily Profile hourly %'s, Table G.6, to the total Sydney annual weekday De-hires.

Table G.12 Total Sydney Current Container De-Hire - Annual Profile

0-6	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-20	20-24	Total
8330	43130	50792	46466	44870	50002	49381	47795	45807	45240	40427	28483	11026	6455	**518204**
1.6%	8.3%	9.8%	9.0%	8.7%	9.6%	9.5%	9.2%	8.8%	8.7%	7.8%	5.5%	2.1%	1.2%	**100%**

The current Sydney daily Container de-hire profile, Table G.13, has been estimated by applying the POCP Shifted Container De-Hire daily Profile hourly %'s, Table G.9, to the total Sydney annual weekday De-hires.

Table G.13 Total Sydney Shifted Container De-Hire - Annual Profile

0-6	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-20	20-24	Total
8330	37241	44903	40577	38981	44113	43493	41906	39919	39351	34539	22594	75802	6455	**518204**
1.6%	7.2%	8.7%	7.8%	7.5%	8.5%	8.4%	8.1%	7.7%	7.6%	6.7%	4.4%	14.6%	1.2%	**100%**

Eliminated Trips

As indicated in Table G.5, it has been estimated that it is possible in many cases to eliminate 2 trips per shifted trip (see figures G.8 & G.9). Given that this occurred in 100% of all cases, the following calculations would apply at the following levels:

- POCP Daily – 92 trips eliminated
- Total Sydney Daily – 581 Trips eliminated
- Total Sydney Annually – 151,602 Trips eliminated

Total Savings

If the shifted trips and eliminated trips potential was realized then the following cost savings calculations would apply.

Table G.14 Estimated Cost Savings Associated with Shifting and Eliminating Trips

Approximately 1/3 of Prime movers doing 'Drop Trailers'	VISA Daily	POCP Daily	Sydney Daily	Sydney Annually
Shifted trips	5	46	290	75802
Dead run trips saved per truck (see figure GX)	2	2	2	2
Total trips saved	10	92	580	151604
Total trip time to Moorebank from Port Botany or return in mins	45	45	45	45
Total time savings in minutes	450	4140	26100	6822180
Total time savings in hours	7.5	69	435	113703
Running cost per hour for a semi trailer	$ 90.00	$ 90.00	$ 90.00	$ 90.00
Total running cost savings	**$ 675.00**	**$ 6,210**	**$ 39,150**	**$ 10,233,270**

Although it was possible to identify directly with VISA that potentially one truck could be divested from their fleet as part of the time savings, it is not possible within the scope of this study to estimate the additional divestment of vehicles that may occur due to the diversity of fleet configurations throughout the industry. As such, no attempt has been made to quantify this potential cost saving at this stage.

G.4 Recommendation

It is recommended that this case study be undertaken as early as possible in October-November 2000.

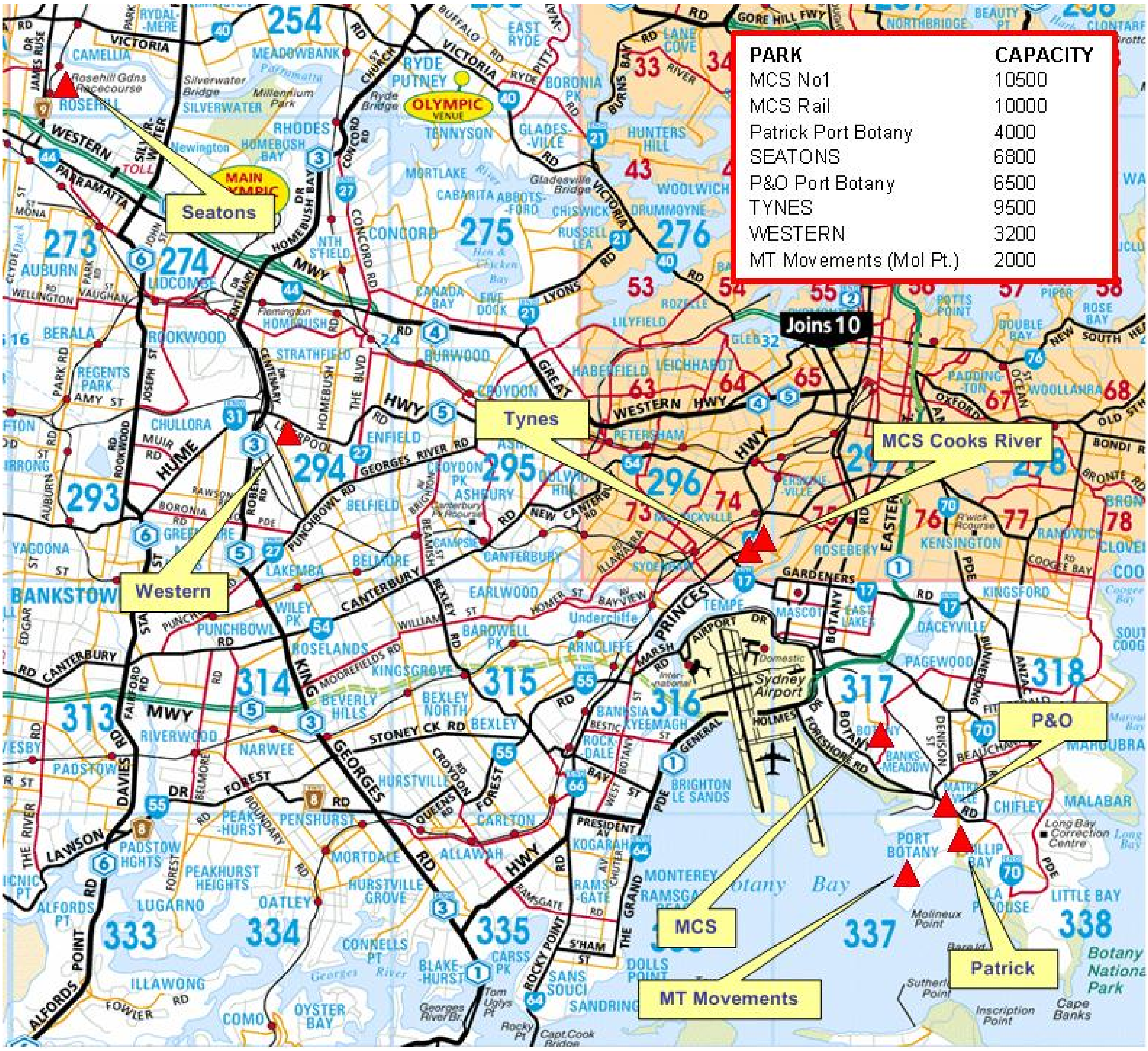


Figure G.10 Sydney Map showing Container Park Locations and Storage Capacity

APPENDIX H : EXTENSION OF HOURS FOR MAJOR DISTRIBUTION CENTRE - MELBOURNE

This appendix contains supporting information for the assessment of a Major Australian Retailer's – Laverton Distribution Centre Case Study considered in Sections 3.3.5 and 4.2 of the report.

H.1 Case Study Objectives and Primary Tasks

The objectives of this case study were to:

- determine to what extent trips (i.e. trucks carrying shipping containers) which either arrive at or depart from the Laverton Distribution Centre (DC) between 6:00am (when the DC opens) and 9:00am and 4:00pm and 5:45pm (when the DC closes) weekdays, can be shifted to an alternative period, outside of peak traffic periods;
- estimate the costs and benefits to both DC and the participating transport company, Patrick Logistics (PL) (e.g., costs such as labour, plant & equipment resources, and benefits such as reduced trips, reduced trip times, etc); and
- if applicable, extrapolate the potential shifts, costs and benefits for DC and PL to the total container traffic population for metropolitan Melbourne and estimate the impact which these shifts will have on traffic congestion in the metropolitan road network, particularly in the AM and PM peak periods.

Primary Tasks for the Case Study

The primary case study tasks required to meet the above objectives were as follows.

- Determine operational parameters at the DC (e.g. operational hours, personnel numbers, personnel shifts, etc).
- Generate a profile of container receival/dispatch at the DC, including common origin (e.g. Port, Transport Company Depot) and destination (e.g. Container Park).
- Identify trips from within the current receival/dispatch profile at the DC that result in trips occurring during peak road traffic periods, e.g. 7:00am to 9:00am and 4:00pm to 6:00pm daily.
- Compare operational parameters between relevant major origin/destinations to determine levels of alignment and identify any relevant mismatch.
- Determine the constraints to shifting these receival/dispatches to non-peak periods.
- Determine the cost, if any, to eliminate these constraints, e.g. labour, plant & equipment.
- Confirm the business and road network benefits resulting from the implementation of these changes.

H.2 DC Operational Parameters

Summary Information

The DC is open Monday to Friday 6:00am to 5:45pm for all operations including the receipt and dispatch of shipping containers. This DC services Retail stores in Tasmania, Victoria, South Australia and Northern territory. It is located in Laverton in the heart of Melbourne's western industrial areas which flank the Western Ring rd. (Figure H.1).

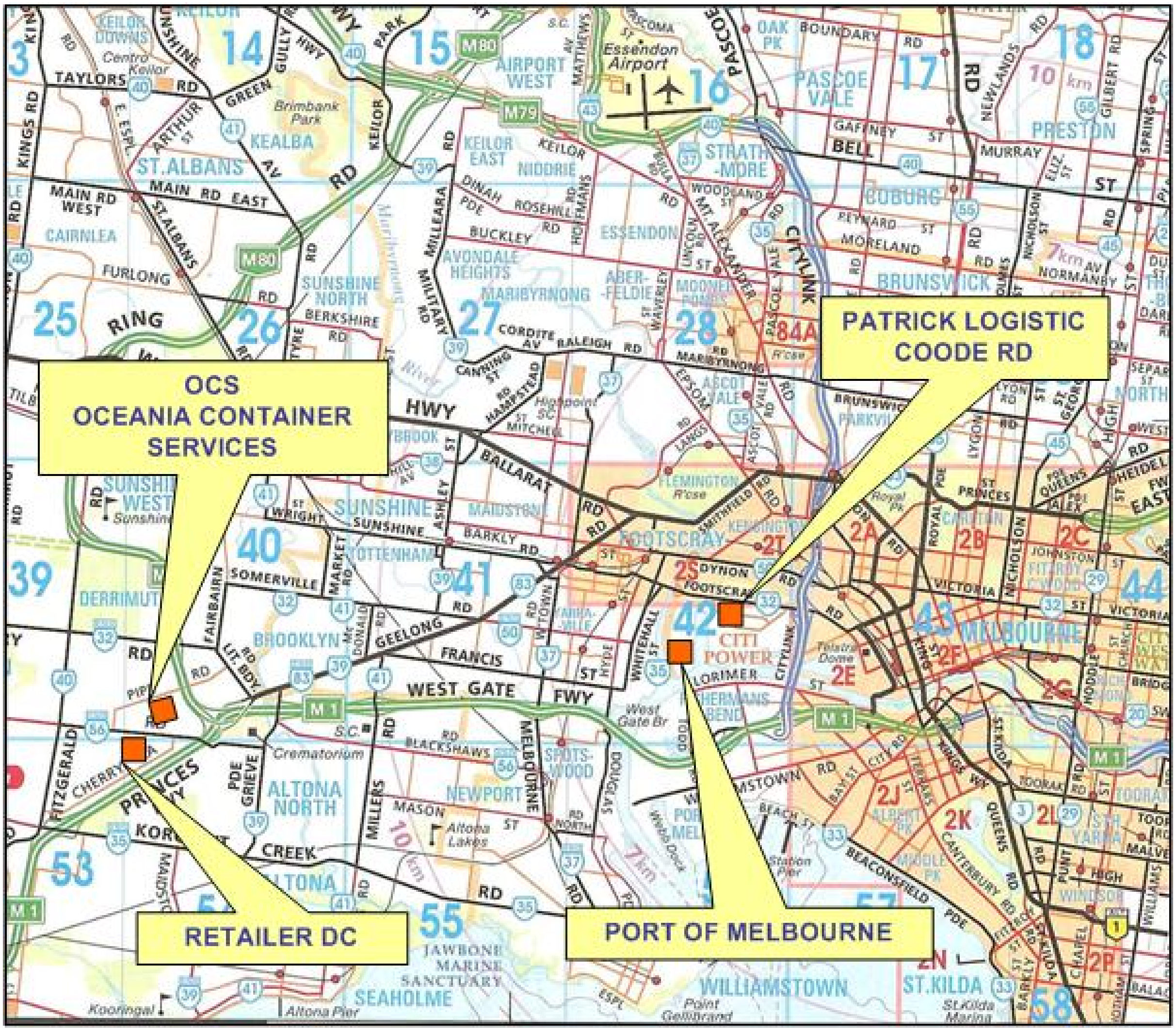


Figure H.1 Location Map for Relevant Stakeholders in this Supply Chain

The Retailer engages Patrick Logistics (PL) as the primary provider of transport services for its containerized goods. PL is located adjacent to the Port of Melbourne in Coode Rd (Figure H.1). PL delivers full containers to the DC either directly from the Port or from storage at the PL Coode Rd site. PL picks up the empty containers from the DC and de-hires the majority (approx 80%) at Coode Rd. A significant volume of the Retail goods are currently delivered in COSCO containers. Currently these containers are exclusively de-hired at OCS (Oceania Container Services). PL has arrangements with most of the major shipping lines to de-hire their empty containers at Coode Rd. As yet they have been unable to strike an arrangement for COSCO containers to be de-hired at Coode Rd. As a result, the balance of empties is mostly being de-hired at OCS, located only a few Km's from the DC.

Collaboration and Cooperation

It was noted during the conduct of this case study that the 2 primary stakeholders in this Supply Chain, The Retailer and Patrick Logistics have developed and maintain a very open and consultative business relationship. This relationship has facilitated significant business improvement for both parties since the commissioning of the Laverton DC less than 12 months ago. Regular communication includes a weekly Container Operations meeting where both parties report KPI's and opportunities for improvement with "mutual" benefits being a key consideration. This behavior will underpin further change including the opportunities identified in this case study. In addition, it is noted that these parties expressed willingness and desire to be aware of and understand industry, environment and community issues and to incorporate consideration for these in their forward planning.

The Shipping Container Process

The DC is given a manifest of Purchase Orders (PO's) for shipping containers, with required delivery dates, by its customers, These customers are all internal, (i.e. the Retail stores). The delivery dates relate to the date when the customer expects to be able to see the ordered stock (i.e. see on-line), available within the Warehouse system (i.e. available for distribution from the DC to their stores). When shipping containers are released from the wharf, decisions relating to timing and location of delivery are based on:

- the timing of the Purchase Order delivery date;
- available rack or storage space within the warehouse;
- availability of space within the DC container yard to store the container; and
- capacity to unload the container (currently the DC unloads on average, 15 containers per day).

Typically goods are received at the Port of Melbourne and picked up within 3 days[2] and transported either directly to the DC or to PL Coode Rd. In the case where there is not the capacity to receive the container at the DC due to one of the constraints above, the container(s) are taken for storage at Patrick's Coode Rd site and then delivered to the DC as required at a later stage. The most common reason for containers being stored at Patrick is lumpy supply, i.e. up to 200 containers bound for the DC may arrive on one ship and subsequently cannot all be stored on site. Although this supply profile can cause extra costs (i.e. additional trips and storage costs at PL), in all likelihood it is the most economic way in which to order product from the international market. It was not within the current scope of this case study to consider the driving factors behind this delivery profile.

At the Coode Rd site, individual locations have been established for each of the Retailer Victorian DC's which PL services. Containers are stored and arranged in a manner as to minimise the number of lifts required to access any container to ensure that they can be quickly retrieved upon request by the DC.

Whether an empty container is removed each time a loaded container is delivered is dependant on the destination of the de-hire. For example, containers bound for de-hire at PL can be picked up at any time of day as PL is open to receive these containers 24 hrs, however, COSCO containers bound for OCS at Laverton can only be picked up with allowance for enough time for their delivery within the hours of 7:00am and 4:00pm.

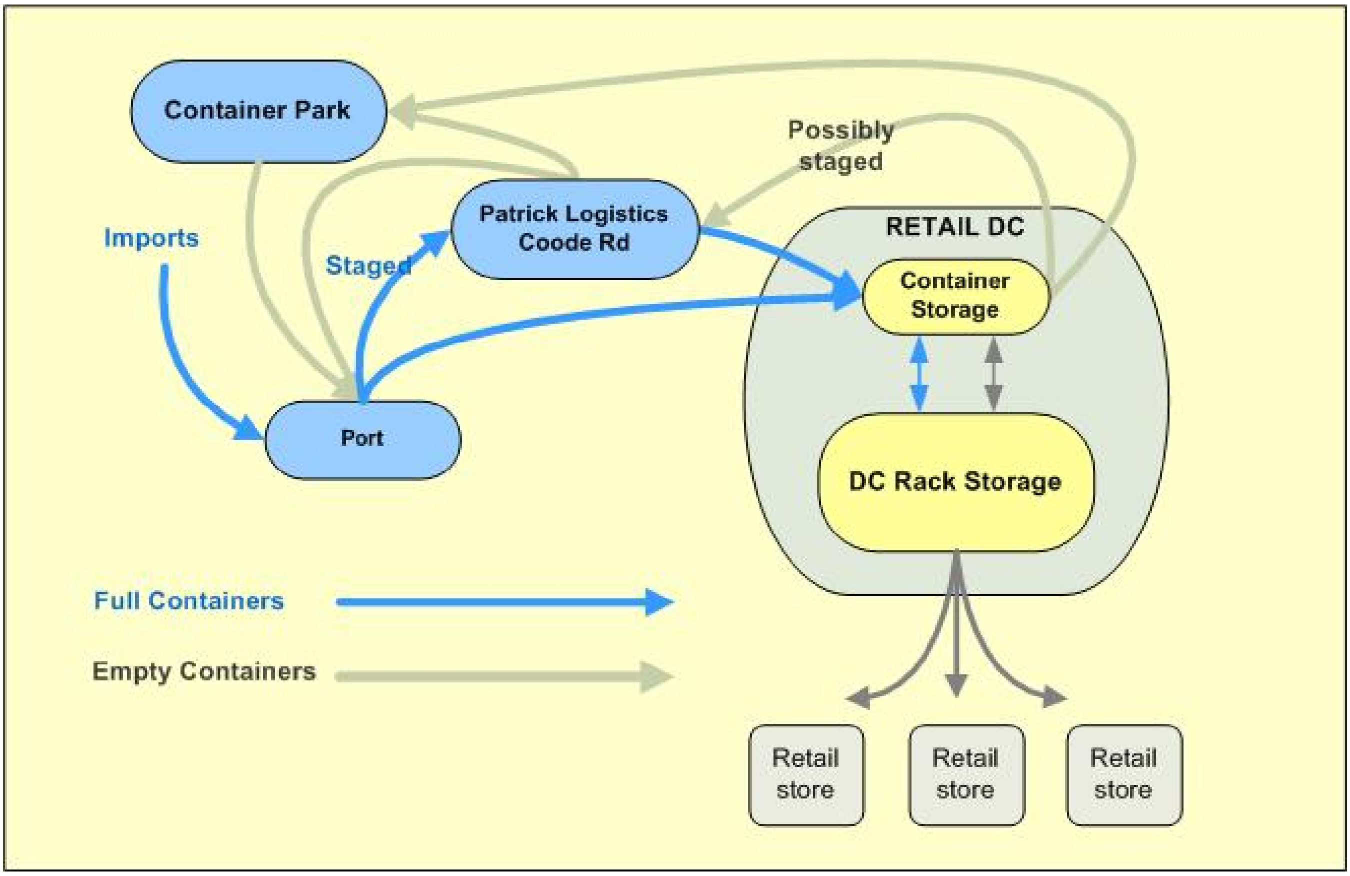


Figure H.2 DC Laverton - Inwards Goods Supply Chain

Figure H.2 shows the common variations in this supply chain.

Note 2: Goods stored at the Port in excess of 3 days will incur storage penalties.

The DC Process

The DC at Laverton is somewhat unique in that it has significant storage capacity for containers and that it is equipped with container movement equipment. This storage and lift capacity is not typical of all DC's, although it would be desirable. There are 2 dedicated employees responsible for the receipt and dispatch of shipping containers working from Mon to Fri 7:00am to 3:15pm. Containers are lifted off and on trucks as they arrive and depart respectively, using an ISO Loader (Figure H.3). The arriving containers are either stored in the container yard (Figure H.4) or taken directly to a loading dock for unpacking. The DC indicated that the majority of containers go into storage at the DC as they arrive and not directly to a loading dock and that they may stay in storage up to 6 weeks if they are well ahead of their PO delivery date or if it is deemed necessary to handle other stock as a priority.

Figure H.3 ISO Loader

The DC is capable of storing 174 TEU's outside of the building which are a combination of full and empty containers. Typically the majority (upward of 80%), are full containers at any one time. The majority of containers received are 40ft containers and as such, storage is approximately 87 actual containers.

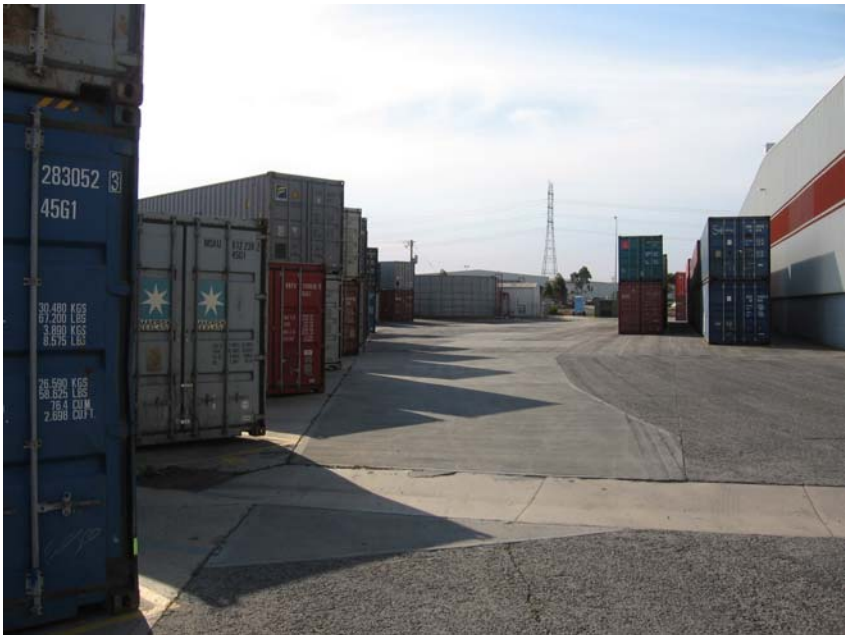


Figure H.4 DC Container Storage Area

As they are required, containers are positioned in the loading docks using the ISO Loader. They are then unpacked and palletized (if not already), and then stored in racks (Figure H.5) in preparation for distribution to Retail outlets.

Figure **H.5** **Palletised Goods on Racking in the Retail DC**

H.3 DC Container – Dispatch/Receival Profile

There is a variety of stock at the DC. Product demand is impacted by:

- normal sales activity;
- extraordinary sales activity such as the Retail toy sale which occurred in July this year; and
- seasonal variation such as the ramp up of sales and associated activity leading to Christmas.

Product supply is impacted by:

- Extraordinary transport incidents (e.g. international shipping delays);
- Supplier industry holidays (e.g. much of the product is sourced from china where seasonal holidays such as Chinese New Year close industry for up to a week).

Stock for extraordinary sales is ordered several months in advance of the dates it is required in stores. It is ordered with a lead time safety buffer, i.e. a typical import lead time plus additional time to cover extraordinary delays. As a result, it is common that the stock arrives portside some time before it is required. Containers carrying stock which arrive well ahead of the required time are either staged at Patrick's Transport depot, stored at the DC, or, if there is space in the DC, they will be unloaded for storage in racks. Demand for extraordinary sales activity is forecast and planned well ahead of required arrival time and as such it is assumed that containers are available with some time flexibility i.e. they can be available for unloading at very specific times. Normal sales activity can be less predictable and as such, the pull through demand for this stock is less predictable and often subject to much shorter lead times. As a result of this greater variability, the demand for this stock and relevant containers with required stock may occur at short notice.

Dispatch/Receival Profile

The average weekly container movement per hour profile was developed using a sample of 3 weeks container movement data and is presented in table H.1 and Figure H.6.

Table H.1 – Average Weekly Container Movements

		8am		9am		10am		11am		12 noon		1pm		2pm		3pm		4pm		5pm	
		In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out
Week 1	Mon - Fri	15	9	9	11	15	12	4	10	11	9	15	14	7	6	0	5	0	0	0	0
Week 2	Mon - Fri	24	12	10	20	18	11	4	10	3	5	2	2	5	1	6	7	1	1	0	3
Week 3	Mon - Fri	14	8	7	11	8	8	16	7	8	15	3	6	2	1	0	2	0	0	1	0
	Daily average	3.8	2.1	1.9	3.0	2.9	2.2	1.7	1.9	1.6	2.1	1.4	1.6	1.0	0.6	0.4	1.0	0.1	0.1	0.1	0.2
	Weekly Average	18.9	10.4	9.3	15.0	14.6	11.1	8.6	9.6	7.9	10.4	7.1	7.9	5.0	2.9	2.1	5.0	0.4	0.4	0.4	1.1

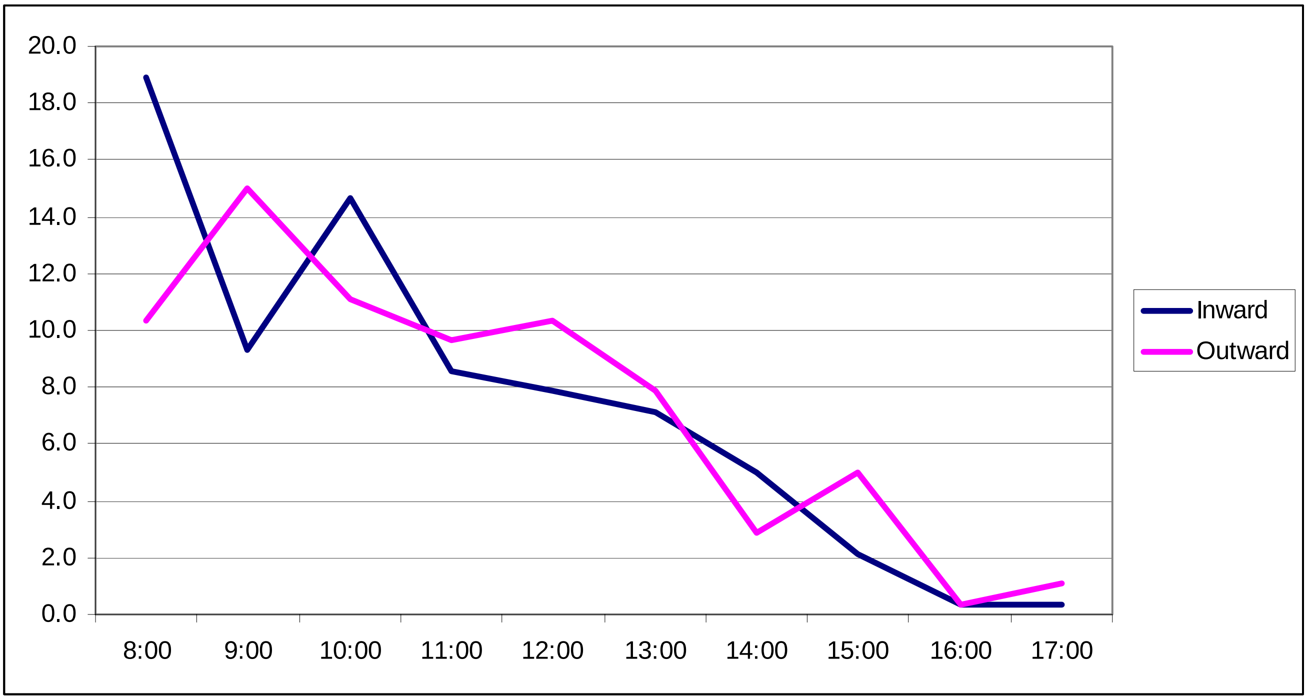


Figure H.6 – Average Weekly container Movements per Hour

Peak Period Trips

The profile indicates a concentration of activity in the morning period peaking at 8:00am and diminishing throughout the day. It is the containers received during the 8:00am and 9:00 am periods and dispatched at 8:00am which are most likely to impact peak hour traffic, although inwards goods are operating in the counter-peak period. There are on average, 7.8 trips per day, or 38.6 trips per week received/dispatched in this peak period. It would be desirable from a road network perspective to shift all of these trips to either before 7:00am or after 9:00am.

H.4 Operational Parameters for the key Origin/Destinations in this Supply Chain

There are 5 Primary stakeholders in the section of this supply chain that are considered in this study and they have the following operating hours.

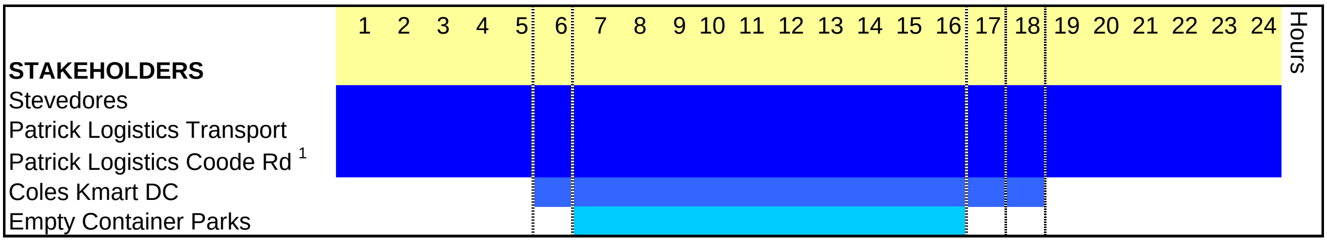


Figure H.7 Operating Hours for the Stakeholders in the Inwards Goods DC Supply Chain

Although there is a misalignment of operating hours, the indications are that, at current levels of activity, this is not operationally impacting the performance of the Distribution Centre and as such, incentive to shift hours of activity is likely to be driven by a commercial rather than operational incentive. This is consistent with the findings of other case studies in this project, with the flow through benefits of shifts providing amongst other, efficiency and productivity gains for the transport operators and the subsequent capacity to reduce transport rates accordingly.

With regard to the delivery of full containers, both the Port and PL are operating 24/7 and as such full containers can be delivered virtually anytime to the DC.

Empty container parks are typically open for limited Hours. They are open typically from 7:00am until 4:00pm. If a container park closes at 4:00pm it may stop accepting vehicles from approximately 3:30pm onward. If it opens at 7:00am, there is often a queue to get into the park. As discussed in previous case studies (Appendix D, Extended Container Park Hours Melbourne and Appendix G Extended Container Park Hours Sydney), there is no time slot booking system at empty container parks, so turn around times at the park are high variable and unpredictable and impact efficiency and utilisation of vehicles.

The PL Coode rd park is open 24 hours as PL has a critical mass of work derived from contracts with companies such as Bunning's providing the economic justification for its extended hours.

H.5 Constraints to Shifting Trips

There are 2 key areas of constraint to shifting trips from the 7:00am to 9:00am period at the DC and these are:

- Container Park Hours ; and
- DC Operational Hours.

Container Park Hours

After PL, the next largest volume of container de-hires are bound for OCS Laverton. This container park's hours are 7:00am to 4:00pm and as such these hours are not aligned with the DC operating hours. Trucks which arrive at the DC outside the operating hours of OCS which could be loaded with an empty for de-hire for OCS are forced to either leave empty or to take a suitable empty, if available, to PL Coode rd.

DC Operating Hours

In order for the DC to receive/dispatch containers at hours outside the current profile they would need to either add a shift with at least 3 personnel or alter the existing shift. Since containers are required to be moved to and from loading bays for unloading during the normal work day, it is not possible to simply move the shift as the receival dispatch site have specialised skills and licensing. It is therefore likely that an additional shift would be required with a minimum of 3 staff to cover operational, OHS security and leave requirements. It would then be possible to shift the majority of these receipts and any de-hires bound for PL to outside the current operating hours and well outside of peak traffic periods. Any de-hires bound for container parks with restricted operating hours (i.e. less than 24 hours) could be loaded during the day, e.g. COSCO containers may be suitable for a bulk run for 1 or 2 vehicles due to the proximity of OCS to the DC.

H.6 Cost and Benefits to Eliminate Constraints and Shift Trips

Cost of Extended Hours at the DC

DC Costs for an additional shift may be 2 persons @ $30 per hour plus a 35% penalty loading as well as a site manager. As discussed previously, site managers are required to cover OHS, Chain of responsibility etc and as such their presence during all operational hours is the Retailer's company policy. It is anticipated that a site manager with full overheads may be valued at approximately $80K per annum.

It is anticipated there would be an average of 6 inward container moves per day up to 9:00am (Table H.1) and a further 6 outward movements (i.e. with a focus on one empty released for each full received), shifted to the extended time period. At a process rate of 6 containers per hour, it would be possible to process all relevant containers in a 2 hour or a 3 hour period to cover extraordinary delays. Based on these assumptions, the most favourable shift extension would be 3:00am to 6:00am as this would mean that the night shift staff overlapped the normal daytime shift and could therefore contribute to the processing of containers during the normal dayshift period. It is assumed that it would be possible to run 2 container processing staff from 3:00am to 6:00am on penalty rates and from then on until 12:15pm on Ordinary time. The DC has indicated that a number of staff are trained and licensed to use the ISO Loader and so it is anticipated that it would be possible to complete container moves from 12:15 with existing staff, and would not be necessary to increase the total number of staff. In this case the cost to open the additional hours would be confined to the penalty rates and these, per person, are detailed in Table H.2 below.

Table H.2 Penalty Rates and Total Cost associated with DC Extended Hours per Day

Staff	Ordinary time	Penalty Rate @35%	Number Hours	Total Penalty Cost per person per Hr	Total Cost for 2 persons for 3 Hrs
Operations	$30.00	$10.50	3	$21	$63

Over a year, the cost of both the management and operational staff extrapolates to $95.7K, being:

- Operations - $15.7K[4] ; and
- Management - $80K[3]

Note 3: Based on 5 days for 50 weeks per annum.
Note 4: Estimation includes Salary, on costs and shift allowance

The total annual cost to open the extended 3 hour shift at the DC would be $95.7K. The total annual trips shifted at 12 per week day (6 in/6 out) would be 3000. The cost per unit would therefore be $31.90.

The greater the duration of the extended shift and or volume of containers processed during the shift, the less the cost per unit would be as the management cost at this stage would be considered fixed and apportioned entirely to the extended hours. It is acknowledged that the management resource would perform other functions not associated with the extended hour's scenario; however, it would be difficult to assess the value of these functions to the DC within the scope of this case study.

Benefits of Extended Hours at the DC

The DC requires the ISO loader to be available for the removal of empty containers from loading bays and the placement of full containers in the same for the commencement of work each morning and then on an as needs basis throughout the balance of the day. Extended hours would mean that container receival/dispatch activity that usually occurs between 6:00am and 9:00am is ceased and that the focus is on ensuring that loading bays are adequately prepared and maintained with containers during this period. At peak container processing levels (i.e. 6 per hour), the hours between 3:00am and 6:00am could handle 18 containers, leaving only 12 moves to occur after 9:00am each day. It would then be possible to cease receipts of containers by 4:00pm allowing time to service loading bays without interruption through until 5:45pm when the DC closes. This would also ease any pressure associated with morning setups of loading bays.

With regard to empty containers, it was indicated that although it is commercially and operationally desirable, from both PL and the DC's perspective, that each time a full container is delivered an empty is de-hired, this is not always the case. Assuming that the ratio of destinations of de-hired containers is approx 75 to 80% PL Coode Rd and 15 to 20% OCS then it may be possible to create greater options for de-hire by adjusting the ratio of empty to full containers stored in the DC yard, thus maximising opportunity to provide an empty out for every full in. This could be achieved by storing more empties on site to ensure there are always containers bound for both major destinations available during relevant time periods.

Operational management at the DC indicated that very infrequently they receive containers that must be unloaded on the same day as they arrive at the DC directly from the port and so by inference it is possible to program the loading of specific containers several days ahead. These containers are either available in storage at the DC or at PL. If the real cost to store a full container (excluding associated lifts) is consistent with the storage of an empty De-hire, then it is feasible to store the full containers at either the DC or PL and to reduce the focus on de-hiring containers ASAP. It could therefore be suggested that space be made available at the DC for a greater number of empties so that when the DC unloads a run of full containers bound for OCS for example, there are still empties (previously stored), bound for PL in storage that can be de-hired outside OCS operating hours. With all early am deliveries, PL could de-hire containers to PL Coode Rd only, as the hours would be aligned. Containers for all other parks could be de-hired during the hours of 9:00am to 4:00pm. These options would increase considerably given implementation of extended hours at all container parks as discussed in the case studies detailed in appendices D & G. Bulk runs of empties to OCS in the middle of the day may be cost effective due to the proximity of OCS to the DC. In addition, if PL were using night time slots at the wharf, which have a greater availability and subsequent flexibility, it is likely that the 3 day free storage from container release at the port could be better utilised. PL could more confidently schedule the pick up of containers out to day 3 in accordance with their actual required unloading time and date at the DC, thus reducing the need for storage at PL or the DC. Where this occurs now, the DC realises savings per container when the need to store at PL is eliminated.

Although there are operational improvement opportunities for the DC, the incentive to change operations in this manner is likely to be in the form of adjusted cartage rates from PL.

Potential Benefits of Extended Hours to PL

Meetings with Patrick Logistics have indicated that they would be able to deliver and retrieve the majority of all containers which are transported to the DC between the hours of 10:00pm and 6:00am and that this would deliver significant advantage to Patrick in terms of fleet efficiency and utilisation. Traveling at night will deliver significant time savings for each trip in the form of turnaround time at the port and traveling time on the road. PL indicated and this is supported by findings from our previous case studies, that it is difficult to schedule desirable time slots at the port during normal business hours, however, a large number of timeslots are available overnight. This means that PL can improve the accuracy of their scheduling in accordance with the DC's needs and maximize port direct deliveries, thus eliminating staging of containers and additional trips. Deliveries that must be made during business hours can be either sourced from PL Coode Rd or focused on those deliveries that have become time critical. It should be noted that both PL and the DC have indicated that PL maintains an on time delivery KPI of 97-98% under current conditions.

As indicated in previous case studies (Appendix D, Extended Container Park Hours Melbourne and Appendix G Extended Container Park Hours Sydney), an average industry cost to operate a semi trailer is approximately $90 per hour or $1.50 per minute. Given that the cost to the DC would be of the order of $31.90 per container delivered, the time savings alone required to break even are of the order of 21 minutes per trip. Although potential improvements in time will vary between the deliveries and de-hire activities, it is likely that an average time saving of 21 minutes could be achieved through a combination of improved road travel times and turnaround times at the port.

The commercial equation should also take into account improvements in fleet utilization which would be realized in a reduction of fixed cost per unit (i.e. hour or Km) as volume increases. The fixed costs for a vehicle operating at a total cost of $90 per hour would be approximately $60 per hour based on 8 hours. If the same total fixed cost ($480) to 11 hours is applied (i.e. incorporating the 3 hour extension), the fixed cost per hour drops to $44 per hour, which is a $16.00 per hour saving or 10.6 minutes equivalent. It may not be possible to run an 11 hour shift in order to generate these fixed cost improvements, however, for the purpose of this case study; it is assumed that other opportunities could be sought by PL in order that 2 shifts could be developed. In this case, a proportion of the savings (i.e. 3 hours from 8, being the DC extended hours) would be attributed to the Retailers DC work.

Given an equivalent time saving of 10.6 minutes attributed to fleet utilisation/fixed cost reduction, the total time improvement required to break even (i.e. PL benefits = DC Costs) would be approximately 10.4 minutes which is considered to be very achievable.

Implementing Changes

As discussed previously, the Retailer and PL operate in an open and collaborative environment. Both companies have indicated a willingness to consider in further detail the potential opportunities deliverable from an implementation of the findings of this case study. An implementation would require operational changes resulting in the costs discussed for the DC and a rate variation to balance this by PL. PL is already in a position to operationally implement any changes adopted.

Both the Retailer and PL indicate that, in the first instance, an extended hour policy would most likely realise the benefits outlined in this case study during the peak season for DC throughput being late July to early December. However, given natural growth in business, the recommended actions could realise the benefits on an all year around basis.

H.7 Recommendation

It is recommended that this case study be undertaken as early as possible in October-November 2000.

APPENDIX I URBAN CONGESTION, ENVIRONMENT AND ECONOMIC IMPACTS

Each of the case study assessments reported in Appendices A and D to I indicates that the re-alignment actions are likely to lead to net reductions in operating costs for the participating businesses. The assessments have indicated that the re-alignment actions are also likely to have a number of additional impacts, with the primary impacts relating to:

- reduced road congestion, and associated user and resource costs;
- reduced vehicle emissions and air pollution;
- increased night time vehicle noise;
- increased efficiencies and productivity; and
- increased economic value.

The variables and procedures to assess each of these impacts are outlined in Appendix C, and the findings from the assessment of the above impacts for the case studies are summarised in the following sections.

I.1 Reduced Road Congestion and User Costs

Each of the re-alignment actions reported in Appendices A and D to I seeks to shift freight vehicle trips from the Am-peak period to other periods of the work day, in particular the ‘night-time’ period. For this study, the ‘night time’ period covers the hours outside the normal work day and peak periods, this being the hours between 6:00pm and 7:00am.

Container movements are made by Rigid or Articulated vehicles and the Food distribution operations considered in the case studies in Appendices E and F are typically made by Rigid or Articulated vehicles.

Rigid and Articulate vehicles are commonly referred to as Heavy Commercial Vehicles (HCV’s) and estimates of HCV trip matrices for peak and other time periods exist in each of Sydney, Brisbane and Melbourne. It was therefore possible to use the HCV trip matrices and associated strategic transport network models to estimate the likely impacts of the re-alignment actions on congestion in the respective road networks. The primary procedures involved for each case study and the resulting estimates of reductions in road congestion are indicated in Sections I.1.1 to I.1.3.

I.1.1 Extended Hours for Shipping Container Movements – Melbourne and Sydney

Shipping containers move through a number of stages in the urban supply chains, with several of the stages being associated with:

- container de-hire at container parks; and
- imported container movement to-from distribution centres.

The detailed assessment of extended hours for shipping container parks in Melbourne (Appendix D) indicated that if container park hours are extended beyond the current 4:00pm close to an 8:00 pm close then it is feasible to shift a component of the container de-hire trips from the Am-peak to the evening period (ie., after 6:00pm). The estimated shift is consistent with the estimate obtained from the preliminary assessment of extended container park hours, reported in Appendix A.

The container de-hire assessments (Appendices A and D) also indicated that there are constraints on the hours of container transport movements in other stages of the shipping container chain (eg., at distribution centres (DCs) and that it is likely to be feasible to achieve shifts from the Am-peak to the evening period in these other stages of the same order as for the de-hire operations at container parks. The case study assessment reported in Appendix H relates to import container movements to/from a major DC in Melbourne. It indicates that it is feasible to achieve shifts in HCV trips for shipping container movements from the Am-peak period to the pre-peak or evening periods through other stages of the shipping container chain.

It is therefore reasonable to assume that a shift of the Am-peak shipping container trips to the pre-peak or evening periods can be achieved across the shipping container chain, and this is the basis of the following estimates of the change in urban road congestion and user costs in Melbourne and Sydney.

Road Congestion and User Cost Reduction in Melbourne

The SKM (2005) study reported estimates of the numbers of vehicle movements associated with the transport of shipping containers in sections of the container supply chain in Melbourne. Estimates of HCV trip matrices for the Am-peak period (7:00 – 9:00am) and other time periods have been developed through the IMIS et al (2006) development of a freight movement model for Melbourne and estimates of Car trips in these periods is available through the MITM strategic model, supported by DOI.

An estimate of the likely impact of the shift in shipping container trips from the Am-peak to the pre-peak of night time periods was then obtained by the following assumptions and analyses.

- Assuming that:
    - all shipping container trips will be by HCV;
    - the majority of vehicle hours of travel (VHT) and vehicle kilometres of travel (VKT) for shipping container trips will occur on arterial roads across Melbourne; and
    - the HCV trips which shift to the pre-peak or evening periods will operate at the ‘free’ speed on the arterial roads.
- Estimating the % reduction in Am-peak HCV trips through the shift of container trips from the Am-peak, resulting in an estimated reduction in HCV trips of 3.5%.
- Using the MITM strategic model to estimate the change in VHT and speeds for Cars and HCV’s in the AM-peak with and without the re-alignment and shift in HCV’s for container movement.
- Using established values of time for Car and Truck travel, to estimate the user and resource cost benefits from the congestion reduction.

The resulting estimated speeds increases and congestion reduction for Melbourne were as follows.

- Vehicle speeds – arterial road network. The vehicle speeds are estimated to increase by:
  - 1% for Cars (including light commercials); and
  - 1.5% for HCV's.
- Vehicle hours of travel – arterial road network. The vehicle hours of travel are estimated to reduce by:
  - 1,000 veh-hrs/day for Cars (including light commercials); and
  - 200 veh-hrs/day for HCV's.

Road Congestion and User Cost Reduction in Sydney

The detailed assessment of extended hours for shipping container parks in Sydney (Appendix G) indicated that if container park hours are extended beyond the current 5:00pm close to an 8:00 pm close then it is feasible to shift a component of the container de-hire trips from the Am-peak to the evening period (ie., after 6:00pm).

Estimates of Car and HCV trip matrices are also available for Sydney and it was therefore possible to use the same assumptions and procedures as used for Melbourne to estimate the likely speed increases and congestion reduction for Sydney and the resulting estimates were as follows.

- Vehicle speeds – arterial road network. The vehicle speeds are estimated to increase by:
  - 0.5% for Cars (including light commercials); and
  - 0.5% for HCV's.
- Vehicle hours of travel – arterial road network. The vehicle hours of travel are estimated to reduce by:
  - 500 veh-hrs/day for Cars (including light commercials); and
  - 250 veh-hrs/day for HCV's.

Potential Additional Congestion Reductions for Other Time Periods

Each of the assessments of the extended container park hours (Appendices D and G) indicated that there are significant proportions of HCV trips for container movement which occur in the Business period (9:00 – 4:00) and Pm-peak (4:00 – 6:00) period. Further, extended container park hours could enable some of these trips to be shifted to the night time period, with associated reductions in road congestion and benefits to road users. It is therefore likely that there would be additional benefits through extended park hours, to the above estimates indicated for the Am-peak period.

I.1.2 Extended Hours for Liquor Distribution

The detailed assessment of extended hours for receival of liquor deliveries in Melbourne (Appendix E) indicated that if receival hours are commenced earlier than the current 9:00 am start to an 8:00 am start then it is feasible to shift liquor delivery trips from the Am-peak to the pre-Am-peak period (ie., before 7:00am).

The timing and sequence of vehicle trips for the liquor distribution process (depicted in Figure 3.1) is likely to be similar to the vehicle trips for the distribution process of other Food commodities. The IMIS et al (2006) study also indicated that approximately 12% of HCV trips in the Am-peak period are associated with the Food sector, and these will be largely associated with distribution to retailers in the Am-peak period.

An estimate of the likely impact of the shift in Food delivery trips from the Am-peak to the pre-Am-peak period was then obtained by the following assumptions and analyses.

- Assuming that:
    - all Food distribution trips will be by HCV;
    - the vehicle hours of travel (VHT) and vehicle kilometres of travel (VKT) for Food distribution trips will occur on arterial and collector-distributor roads across Melbourne; and
    - the HCV trips which shift to the pre-Am-peak period will operate at the ‘free’ (ie., uninterrupted) speed on the major roads (ie., freeways, arterials and collectors).
- Estimating the % reduction in Am-peak HCV trips through the shift of Food distribution trips from the Am-peak. This resulted in an estimated reduction in HCV trips of 7%.
- Using the MITM strategic model to estimate the change in VHT and speeds for Cars and HCV’s in the AM-peak with and without the re-alignment and shift in HCV’s for Food movement.
- Using established values of time for Car and Truck travel, to estimate the user and resource cost benefits from the congestion reduction.

The resulting estimated speeds increases and congestion reduction for Melbourne were as follows.

- Vehicle speeds – major road network. The vehicle speeds are estimated to increase by:
    - 0.9% for Cars (including light commercials); and
    - 1.4% for HCV’s.
- Vehicle hours of travel – major road network. The vehicle hours of travel are estimated to reduce by:
    - 1,800 veh-hrs/day for Cars (including light commercials); and
    - 300 veh-hrs/day for HCV’s.

Potential Additional Congestion Reductions for Other Time Periods

The vehicle trip mapping for the liquor case assessment (Appendix E) indicated that a slight advance of the start time for the first delivery run in a day is likely to have a significant ‘multiplier’ effect during the vehicle runs and trips later in the day. In particular, it is likely to enable the set if delivery trips to be completed more quickly and the final return-to-depot trip to be completed before the start of the Pm-peak period. This will then further reduce road congestion, and provide additional benefits beyond the above levels estimated for the Am-peak.

I.1.3 Extended Hours for Cold Food Distribution

The detailed assessment of extended hours for receival of cold food deliveries in Brisbane (Appendix F) indicated that if receival hours are commenced earlier than the current 7:00 am start to a 6:00 am start then it is feasible to shift delivery trips from the Am-peak to the pre-Am-peak period (ie., before 7:00am).

The timing and sequence of vehicle trips for the cold food distribution process (depicted in Figure 3.1) is likely to be similar to the vehicle trips for the distribution process of other Food commodities. As indicated in Section I.1.2, the IMIS et al (2006) study in Melbourne indicated that approximately 12% of HCV trips in the Am-peak period are associated with the Food sector. It is reasonable to assume that there is a similar component for the Food segment in Brisbane.

An estimate of the likely impact of the shift in Food delivery trips from the Am-peak to the pre-Am-peak period was then obtained by the following assumptions and analyses.

- Assuming that:
  - o all Food distribution trips will be by HCV;
  - o the vehicle hours of travel (VHT) and vehicle kilometres of travel (VKT) for Food distribution trips will occur on arterial and collector-distributor roads across Brisbane; and
  - o the HCV trips which shift to the pre-Am-peak period will operate at the ‘free’ (ie., uninterrupted) speed on the arterial roads.
- Estimating the % reduction in Am-peak HCV trips through the shift of Food trips from the Am-peak. This resulted in an estimated reduction in HCV trips of 7%.
- Using the BSTM strategic model to estimate the change in VHT and speeds for Cars and HCV’s in the AM-peak with and without the re-alignment and shift in HCV’s for Food movement.
- Using established values of time for Car and Truck travel, to estimate the user and resource cost benefits from the congestion reduction.

The resulting estimated speeds increases and congestion reduction for Brisbane were as follows.

- Vehicle speeds – major road network. The vehicle speeds are estimated to increase by:
  - o 0.5% for Cars (including light commercials); and
  - o 0.6% for HCV’s.
- Vehicle hours of travel – major road network. The vehicle hours of travel are estimated to reduce by:
  - o 900 veh-hrs/day for Cars (including light commercials); and
  - o 100 veh-hrs/day for HCV’s.

Potential Additional Congestion Reductions for Other Time Periods

The vehicle trip mapping for the cold food case assessment (Appendix F) indicated that a slight advance of the start time for the first delivery run in a day is likely to have a significant ‘multiplier’ effect during the vehicle runs and trips later in the day. In particular, it is likely to enable the set if delivery trips to be completed more quickly and the final return-to-depot trip to be completed before the start of the Pm-peak period. This will then further reduce road congestion, and provide additional benefits beyond the above levels estimated for the Am-peak.

I.2 Reduced Vehicle Fuel Consumption, Emissions and Pollution

Previous research has established that vehicle emissions in a particular time period (eg., Am-peak) at an urban network level are directly related to the VHT in the urban road network during the time period. The IMIS et al (2005) study of the environmental impacts of the M5 Motorway in Sydney indicated that the a 3.9% reduction in vehicle hours of travel leads to reductions of 3.6% in fuel, 4.5% in HC, 1.5% in NOx, 3.6% in CO_2 and 3.6% in particulates.

Thus, the estimated reductions in VHT for several of the cases reported in Sections I.1.1 to I.1.3, are likely to lead to the associated percentage reductions in vehicle fuel consumption and emissions indicated in Table I.1.

Table I.1 Estimated Reductions in Fuel and Emissions from Re-alignment

Variable	Melbourne Container case	Brisbane Cold food case	Sydney Container case
VHT	-1.2%	-0.8%	-1.5%
Fuel	-1.1%	-0.7%	-1.4%
HC	-1.4%	-0.9%	-1.7%
NOx	-0.5%	-0.3%	-0.7%
CO2	-1.1%	-0.7%	-1.4%
Particulates	-1.1%	-0.7%	-1.4%

I.3 Night Time Vehicle Noise and Social

A number of areas in Sydney, Brisbane and Melbourne have environmental protection orders (EPO's) which include restrictions on HCV's in specified 'night time' periods.

The assessments of container park hours in Melbourne and Sydney did not include a detailed assessment of the existing EPO's and whether the impacts of the proposed extensions on these. However, the assessments did indicate that the extensions identified in the case studies would not violate existing noise constraints and that the impacted communities would benefit from reduced road congestion in daytime periods.

The proposed extensions to liquor and cold food distribution hours would not violate existing noise restrictions in Melbourne or Brisbane.

Extension of hours of supply chain operations will also require increased personnel hours in night time periods (eg., truck drivers, supply node personnel), with possible social impacts on these persons and their associated family and community networks.

Consultations with Reference Group members indicated that the night time noise impacts, noise-congestion trade-offs and potential personnel-related social impacts require more detailed consideration, and this can be during the case study implementation phase of this re-alignment Project.

I.4 Increased Efficiencies and Productivity

As indicated in each of the case study assessments, each of the participating Transport Operators indicated that they would expect to achieve increased productivity of their truck fleets if the proposed re-alignments occurred.

These productivity gains, if realised, would increase the benefits of the re-alignments and their commercial viability.

I.5 Increased Economic Value

The direct economic value of the user cost savings from the congestion reductions indicated in Sections I.1.1 to I.1.3 were estimated to be:

- Melbourne container park hours - $ 4 million / year;
- Melbourne food distribution - $ 5 million / year;
- Brisbane food distribution - $ 3 million / year; and
- Sydney container park hours - $ 2 million / year.

As indicated in Section C.8.1, Appendix C, reductions in business-related operating costs are likely to lead to increased economic activity and increased GDP. Further, the growth in GDP can be estimated from the business-related cost components of the road user cost reductions.

The additional economic benefits were estimated for the Melbourne Container Park Hours Extension case (Section I.1.1), and indicate that this adds a further $ 1 million/year of value to the direct user benefits indicated in Section I.1.1.