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Economic Cooperation**

Road Safety Measures for Heavy Vehicles in APEC Transport Supply Chains

Final Report

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EXECUTIVE SUMMARY



THE PROJECT

ARRB Group Ltd (ARRB) has been engaged by the Road Safety Sub-group of the Asia Pacific Economic Cooperation (APEC) Transportation Working Group (TPT-WG) to investigate how the safety of heavy vehicles in the supply chain logistics area of selected APEC economies in the South-East Asian region could be improved. The specific objectives of the investigation were to:

- identify road safety issues relating to heavy vehicles in selected APEC economies
- quantify the economic impacts on the supply chain of heavy vehicle crashes
- identify any barriers to improving safety that currently exist
- create a compendium of safety interventions, supported by case studies, which could be applied in developing economies.

ARRB's investigation comprised four key tasks, as follows:

1. a survey of road transport/road safety agencies of governments in all APEC economies
2. a literature review, focussing on heavy vehicle safety issues in the Asia Pacific region
3. consultation visits with stakeholders from selected APEC member economies (Malaysia, Thailand and Viet Nam), to determine issues and priorities for heavy vehicle safety
4. development of a compendium of potential heavy vehicle safety interventions.

The findings of each of the project tasks are summarised below.

Scale and nature of the road safety problem

Road crashes account for an estimated 1.27 million deaths and 50 million injuries worldwide each year, with over 90% of three deaths occurring in developed countries. They cost the equivalent of 1 to 3% of an economy's gross national product (GNP).

Statistics on the number of truck crashes were only available for a few APEC economies. Extrapolating from casualty rates due to truck crashes in these economies resulted in a tentative estimate of 420,000 deaths and injuries per year across all APEC economies.

Problems were identified in a number of areas:

- Human factors – driver fatigue, driver education, speeding, awareness of road safety issues, impaired driving, work schedule and expectations, skills shortages.
- Vehicle factors – overloading, load balancing, roadworthiness, technology, safety features, maintenance.

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- Infrastructure – road type and speed limit, road features.
- Legislation and regulation – road safety guides for truck drivers, instruction manuals, vehicle and cross-border legislation and enforcement.

During the course of visits to three member economies (see below), issues of particular relevance to the supply chain sector were identified. The remainder of the literature review focussed on actions to address these issues – driver training, eco-driving, fatigue management and corporate safety programs.

Driver training

The availability of well-qualified drivers was identified as an issue throughout the literature review and was mentioned as an issue by almost all of the groups contacted during the subsequent visits to APEC economies. To address this need, driver training was investigated as part of the literature review. Although the research showed that there is a strong belief in the efficacy of training, there is very little empirical evidence to show it is effective in reducing crashes, and it was also found that many courses do not follow good instructional design practice. A major Swedish study has demonstrated that workplace training can be highly effective in reducing crashes, with the two most effective techniques being hands-on driver training, and group discussion sessions.

Eco-driving

Although there was little mention of eco-driving during the discussions with stakeholders in APEC economies, and no strongly expressed demand for it, training in eco-driving techniques has demonstrated safety benefits as well as economic and environmental benefits. Eco-driving is a term used to describe the concept of a modified driving style which is aimed at achieving a reduction in fuel usage, and encompasses a number of specific techniques which are each aimed at operating the vehicle's engine as efficiently as possible.

Alongside these benefits, there is the potential for the modified driving style to also deliver a road safety benefit, as certain eco-driving techniques can contribute to a safer on-road environment. Particularly, less gear changes may reduce fatigue and adopting a smooth driving style with respect to acceleration could potentially prevent some loss-of-control events, and may reduce the risk of rear-end collisions from less or sudden braking.

Fatigue management

Fatigue is acknowledged as a major problem in the road transport industry. It is a complex issue, many aspects of which are not well understood. It is affected by sleep patterns and hours of duty. Relatively simple remedies are available which are likely to have a significant impact. These include fatigue management programs, action to encourage better rest and sleeping at home, and the use of power naps as short-term measures.

Corporate safety management

Raising the safety performance of organisations and sustaining it in the longer term will require operators to embrace a safety culture and commit to a far-reaching range of measures to ensure that all worthwhile measures to improve safety are implemented. Although this may be difficult in a competitive environment, the high value of services and the premium on safety and reliability in the supply chain sector should encourage their uptake.

Accreditation schemes are one way to encourage better safety practice. In exchange for agreement to abide by standards, and making compliance with the standards open to audit, the operator receives certain advantages. This can be simply a quality assurance guarantee, in the case of industry-operated schemes, or more tangible advantages such as a reduction in mechanical inspection requirements, weighing at official stations and other checks with government operated schemes.

Response to the questionnaire

The questionnaire was developed in close consultation with the client, and distributed to member economies on 19 May 2011. Attendees at the APEC Transportation Working Group meeting in June 2011 in Brisbane, Australia were reminded of the importance of completing the questionnaire, and a further email reminder was sent on 5 July. Despite these reminders, there was a disappointingly low level of response, with only six replies received. Although the low response rate limits what can be said about the road transport industry across APEC, the responses do provide an interesting cross-section which provides some insights into the status of truck safety across the economies, and helped to formalise the recommendations for the compendium.

Visits to member economies

A program of visits to Malaysia, Thailand and Viet Nam was undertaken in July 2011 to ascertain the issues associated with heavy vehicles in these economies, the priorities attached to these issues and whether any innovative programs which might be suitable for inclusion in the compendium had been undertaken. Government and private sector stakeholders were consulted in all three economies. The discussion with each stakeholder group is summarised in the report.

Similar problems were found in all three economies. The most pressing problems for the road transport industry are overloading and a large number of older, less-capable vehicles. However, for trucks in the logistics supply chain, the main issues are:

- availability of well-qualified drivers, with a good understanding of their responsibilities and the risk factors associated with truck driving
- better management of fatigue, extending beyond driving hours to include life-style factors
- more extensive use of on-board tracking devices to monitor devices and speeds; coupled with this there was a need to teach companies how to make best use of the information the systems provided to improve their business performance.

The compendium of road safety interventions

Based on the results of the literature review, visits to stakeholders in APEC economies, and the questionnaire, a compendium of road safety interventions was drafted. The criteria for inclusion in the compendium were a demonstrated need for the proposed measures, measures which are appropriate to the state of development of the industry and the administrative capacity of the economies, measures which are evidence-based and measures which are immediately applicable rather than long-term aspirations.

The compendium focuses on specific areas – driver training, eco-driving, fatigue management, and corporate safety management – and also provides some proposals for strategies beyond these actions. The contents of the compendium include:

Driver training

- pilot driver training institute
- in-service training based in the workplace

Eco-driving

- eco-driving materials
- training in eco-driving
- training to enable managers to use monitoring equipment to sustain eco-driving

Fatigue

- formal workplace fatigue management programs
- DVD or other material to promote good rest and sleep conditions in the home

Corporate safety programs

- government program similar to the NHVS or Trusted Carrier programs
- industry-sponsored programs
- workshop on the business benefits of good safety practice

Further actions

- strategy to address safety issues in the logistics supply chain sector
- operator questionnaire
- extending to the wider industry

A potential role for APEC

The specific actions which APEC could take to advance safety in the heavy vehicle logistic supply chain are:

- sponsor and fund the survey of individual operators described above
- sponsor workshops and seminars to promote safety awareness among operators
- ensure hands-on training in eco-driving, fatigue management and corporate safety programs is available for the economies who choose to follow it up
- lobby for and support the development of a globally-focused good practice manual for heavy vehicle safety, directed at all sectors of the road transport industry; alternatively, fund the development of a similar manual for APEC economies
- assist developing economies to establish centres of excellence in driver training
- encourage governments in APEC economies to develop safety strategies for heavy vehicles in the logistic supply chain.

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1 INTRODUCTION

ARRB Group Ltd (ARRB) has been engaged by the Road Safety Sub-group of the Asia Pacific Economic Cooperation (APEC) Transportation Working Group (TPT-WG) to undertake a project to investigate how the safety of heavy vehicles in the supply chain logistics area of selected APEC economies in the South-East Asian region could be improved. This project was developed in response to directives from APEC Leaders and Transportation Ministers and meets the TPT-WG's priorities relating to the APEC Supply Chain Connectivity Framework.

At their meeting in response to ABAC Australia on 8 February 2010 in Melbourne, Australia, Regional Transport Ministers or their representatives from Australia, Malaysia, New Zealand, Singapore and Thailand agreed that Australia with Malaysia, New Zealand, Singapore and Thailand develop a project to document and exchange information on case studies and local experience on road safety measures and safety standards for heavy vehicles.

The specific objectives of the investigation were to:

- identify road safety issues relating to heavy vehicles in selected APEC economies
- quantify the economic impacts on the supply chain of heavy vehicle crashes
- identify any barriers to improving safety that currently exist
- create a compendium of safety interventions, supported by case studies, which could be applied in developing economies.

This document is the final report for the project. It brings together the findings from the four project tasks. These are presented in the order of project implementation, as follows.

1. a literature review, focussing on heavy vehicle safety issues in the Asia Pacific region
2. a questionnaire of road transport/road safety agencies of governments in all APEC economies
3. consultation visits with stakeholders from selected APEC member economies (Malaysia, Thailand and Viet Nam), to determine issues and priorities for heavy vehicle safety
4. development of a compendium of potential heavy vehicle safety interventions.

However, it should be noted that for reasons of practicality, the chronological completion of the four tasks did not follow this order. Due to the expected long lead times in terms of receiving the results of the questionnaire, it was drafted first, and sent out to each of the 21 member economies for input. Concurrently, the first stage of the literature review (covering heavy vehicle safety issues and the nature of the heavy vehicle road safety problem in APEC economies) was undertaken, alongside the consultation visits to the South-East Asian economies. This was done in order to give the project team a good understanding of the issues and priorities for the logistic supply chain sector from the point of view of the authorities and industry in that part of the world.

This in turn proved to be valuable in setting the direction for the remainder of the literature review, and further on, the compendium of safety interventions. The remainder of the literature review focussed on researching possible safety interventions for inclusion in the compendium, based on the results obtained via the questionnaire responses and visits to member economies. This approach is depicted in Figure 1.1.

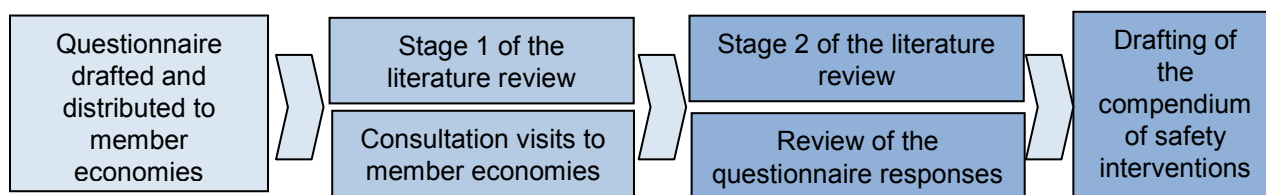


Figure 1.1: Flow chart depicting the order of project tasks completed

Delays in receiving some responses to the questionnaire meant that completion of the report on the questionnaire occurred relatively late in the project. Unfortunately, overall response to the questionnaire was relatively low, with only six economies (Australia, New Zealand, Japan, the Philippines, Malaysia and Viet Nam) providing responses. Additionally, the data provided was incomplete, as data was either unavailable, or fields within the questionnaire were returned blank. However, material gathered from the questionnaire did help to fill some knowledge gaps from the literature review.

Due to the complex relationship and existence of inter-dependencies between project tasks, the report has been structured in the order set out below, in an attempt to guide the reader through the project tasks and findings of each section in a clear and unambiguous manner:

- Section 2: The findings of the first stage of the literature review, which details heavy vehicle safety issues on a global scale, and the scale and nature of the heavy vehicle road safety problem in APEC economies.
- Section 3: A summary of the findings of the questionnaire.
- Section 4: A summary on the visits to member economies.
- Section 5: The findings of the second stage of the literature review, which details research conducted into possible safety interventions for inclusion in the compendium.
- Section 6: The compendium of proposed road safety measures.

2 LITERATURE REVIEW – STAGE 1

This section of the report documents the first stage of Task 1, the literature review. The review outlines the key safety concerns for developing countries drawing from existing literature and highlights any major knowledge or information gaps. Although the full completion of the literature review was originally intended to occur prior to the consultation visits, the literature review was split into two stages. The first focusing on the scale of heavy vehicle safety issues, both globally and in the APEC economies. The second stage focused on issues which were suitable for inclusion in the compendium and is presented in Section 5.

The decision to split the literature review into two stages was made because it was considered that there was the potential for the results of the questionnaire and the visits to the member economies to provide valuable insights into the heavy vehicle safety issues faced by the supply chain sector in member economies. Work on the second stage of the literature review was therefore delayed until after the visits to member economies so that it could focus on the issues of most relevance.

Stage 1 of the literature review has been structured as follows:

- Section 2.1 provides an overview of the global extent of heavy vehicle safety issues, including data revealing the scale of the problem.
- Section 2.2 refines the findings and focuses on the scale and nature of road safety problems in APEC economies.

2.1 The Global Extent of Heavy Vehicle Safety Issues

This section of the report outlines the extent of heavy vehicle safety issues on a global scale in terms of crash statistics and other key measures, and provides further detail regarding the technical terms and definitions used in this report.

2.1.1 *The Scale of the Problem*

Road crashes account for an estimated 1.27 million deaths and 50 million injuries worldwide each year, with over 90% of the reported deaths occurring in developing countries (World Bank 2011, World Health Organisation (WHO) 2009). The combined injury, funeral and social costs of crashes pose a large financial problem for developing countries. This problem is further compounded as the age group most affected by road crashes is 5-44 years of age, the age group which typically comprises the most economically active members of society.

According to World Bank statistics, road crashes cost the equivalent of 1% to 3% of a country's Gross National Product (GNP), an amount which could be crippling for developing countries (World Bank 2011). Developing economies within the Asia-Pacific Economic Cooperation (APEC) have experienced unprecedented economic growth over the past decade, with economies such as the People's Republic of China (referred to as China from here on) growing at an average annual rate of 14%. This rapid growth in income has led to an increase in the demand for all classes of goods and personal travel. This demand has largely been met through increased motorisation, which in turn has resulted in a major increase in road safety problems.

In addition, globalisation has led to the creation of regional trade agreements which have spurred the growth in the role and size of the heavy vehicle fleet across all countries. According to the International Road Federation (IRF), the world truck and lorry fleet in 2007 was 265.6 million in 155 countries (IRF 2010).

Road safety plays a crucial role in the logistics sector as it affects costs and competitiveness in the country. For individual transport operators, crashes result in increased operating costs due to vehicle repairs, hire of replacement vehicles, insurance costs and administrative costs while serious failures can result in a loss of reputation, threatening the viability of the business.

Freight costs are generally higher in developing than in developed countries. International freight costs as a proportion of imports were estimated to be higher for African countries at 11.9% compared to 3.9% for developed countries. Developing countries are therefore disproportionately affected by the costs which result from crashes. Transport costs in developing countries are also exacerbated by the poor quality of much of the infrastructure, by the regulatory and institutional framework and by the efficiency of the distribution system (United Nations Conference on Trade and Development (UNCTAD) 2006).

2.1.2 Definition of Terms

Definitions of heavy vehicles vary across different countries. Large load-carrying vehicles are commonly referred to as either trucks (typical American and Australian usage) or lorries (usage in Britain and much of the British Commonwealth). In this report, the term 'heavy vehicle' will be used to describe large load-carrying vehicles. Under the definitions of Australia's National transport Commission (NTC 2006), heavy vehicles are generally defined as any vehicle with a gross vehicle mass (GVM) of more than 4.5 tonnes, including rigid trucks, articulated trucks and trucks towing heavy trailers. This definition is used in this report, although it is worth noting that some countries define heavy vehicles with a slightly lower GVM of 3.5 tonnes (Land Transport Authority (LTA) 2011, New Zealand Transport Agency (NZTA)).

The term 'supply chain' also covers a wide range of freight- transport-related activities. Broadly, it involves the movement of materials from the producer to the consumer at all stages of the production cycle, including purchasing, manufacturing, storage, transportation and customer service (Supply chain definitions 2011). For the purposes of simplification, as used in this report, 'supply chain' refers to the network of consignors and consignees across APEC economies involved in transporting consumer and manufactured goods by road.

There is no conventional definition of developed and developing country. The World Bank classifies all low and middle income countries as developing. These are countries with Gross National Income (GNI) per capita of US\$975 or less and between US\$976 and US\$3855. The United Nations (UN), using the Human Development Index (HDI), classifies developing countries as those that have not achieved a significant level of industrialisation relative to population size and have a medium to low standard of living.

2.2 Road Safety Problems in APEC Economies

This section outlines the extent of the heavy vehicle safety problem within APEC, highlighting the issues in the developing member economies. As there is limited research on heavy vehicle safety in developing countries, the review will also present issues pertaining to both developing and developed countries outside of APEC to provide comparisons on the issues and mitigation measures.

2.2.1 Scale of the Road Safety Problem

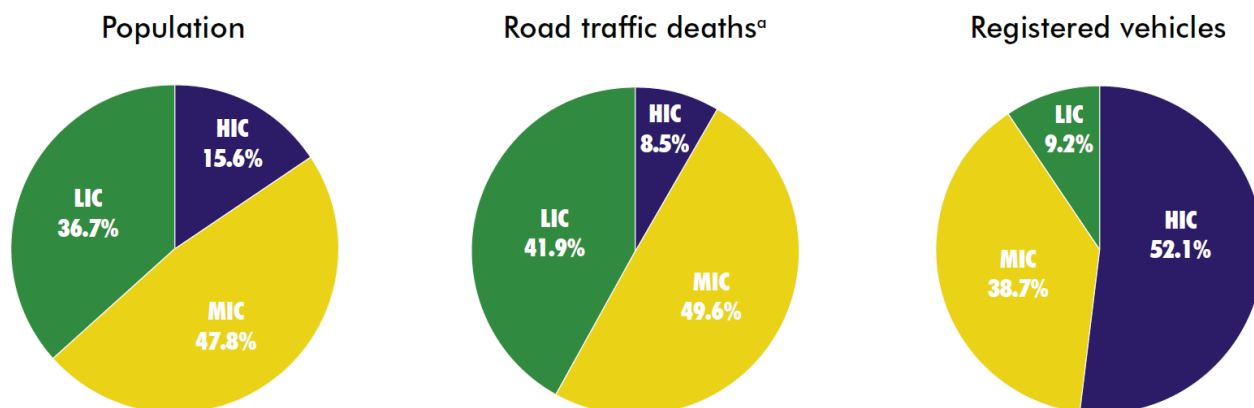
Research on road safety indicates that road crashes are one of the leading causes of death in the 5-44 years age group. Figure 2.1 shows that in 2004, road crashes were the second highest cause of death in the 5-14 years group, the highest cause for the 15-29 years group and the third highest cause for the 30-44 years group (WHO 2009, World Bank 2011).

RANK	0–4 YRS	5–14 YRS	15–29 YRS	30–44 YRS	45–69 YRS	70+ YRS	TOTAL
1	Perinatal causes	Lower respiratory infections	Road traffic injuries	HIV/AIDS	Ischaemic heart disease	Ischaemic heart disease	Ischaemic heart disease
2	Lower respiratory infections	Road traffic injuries	HIV/AIDS	Tuberculosis	Cerebrovascular disease	Cerebrovascular disease	Cerebrovascular disease
3	Diarrhoeal diseases	Malaria	Tuberculosis	Road traffic injuries	HIV/AIDS	Chronic obstructive pulmonary disease	Lower respiratory infections
4	Malaria	Drownings	Violence	Ischaemic heart disease	Tuberculosis	Lower respiratory infections	Perinatal causes
5	Measles	Meningitis	Self-inflicted injuries	Self-inflicted injuries	Chronic obstructive pulmonary disease	Trachea, bronchus, lung cancers	Chronic obstructive pulmonary disease
6	Congenital anomalies	Diarrhoeal diseases	Lower respiratory infections	Violence	Trachea, bronchus, lung cancers	Diabetes mellitus	Diarrhoeal diseases
7	HIV/AIDS	HIV/AIDS	Drownings	Lower respiratory infections	Cirrhosis of the liver	Hypertensive heart disease	HIV/AIDS
8	Whooping cough	Tuberculosis	Fires	Cerebrovascular disease	Road traffic injuries	Stomach cancer	Tuberculosis
9	Meningitis	Protein–energy malnutrition	War and conflict	Cirrhosis of the liver	Lower respiratory infections	Colon and rectum cancers	Trachea, bronchus, lung cancers
10	Tetanus	Fires	Maternal haemorrhage	Poisonings	Diabetes mellitus	Nephritis and nephrosis	Road traffic injuries
11	Protein–energy malnutrition	Measles	Ischaemic heart disease	Maternal haemorrhage	Self-inflicted injuries	Alzheimer and other dementias	Diabetes mellitus
12	Syphilis	Leukaemia	Poisonings	Fires	Stomach cancer	Tuberculosis	Malaria
13	Drownings	Congenital anomalies	Abortion	Nephritis and nephrosis	Liver cancer	Liver cancer	Hypertensive heart disease
14	Road traffic injuries	Trypanosomiasis	Leukaemia	Drownings	Breast cancer	Oesophagus cancer	Self-inflicted injuries
15	Fires	Falls	Cerebrovascular disease	Breast cancer	Hypertensive heart disease	Cirrhosis of the liver	Stomach cancer
16	Tuberculosis	Epilepsy	Diarrhoeal diseases	War and conflict	Nephritis and nephrosis	Inflammatory heart diseases	Cirrhosis of the liver
17	Endocrine disorders	Leishmaniasis	Falls	Falls	Oesophagus cancer	Breast cancer	Nephritis and nephrosis
18	Upper respiratory infections	Violence	Meningitis	Diarrhoeal diseases	Colon and rectum cancers	Prostate cancer	Colon and rectum cancers
19	Iron deficiency anaemia	War and conflict	Nephritis and nephrosis	Liver cancer	Poisonings	Falls	Liver cancer
20	Epilepsy	Poisonings	Malaria	Trachea, bronchus, lung cancers	Mouth and oropharynx cancers	Road traffic injuries	Violence

Source: WHO (2009).

Figure 2.1: Leading causes of death by age, world – 2004

WHO estimates that low and middle income countries (also referred to as developing countries) have higher road fatality rates than high income countries. According to research, developing countries constitute over 90% of road traffic deaths and only 48% of the world's registered vehicles (WHO 2009). This data is outlined in Figure 2.2.



^a 30-day definition, modelled data.

HIC = high-income countries; MIC = middle-income countries; LIC = low-income countries

Source: WHO (2009).

Figure 2.2: Population, road deaths and registered vehicles by world income group

While it is evident that low and middle income countries are disproportionately represented in the crash statistics, care should be taken when carrying out such comparisons across countries. It is crucial to note that differences in crash definitions, vehicle classification, definitions of impairment and other driver characteristics could affect the comparisons. In particular, the ‘under-reporting’ of crashes, regional variations in the rate of under-reporting across different countries also has the potential to distort such comparisons.

Another factor which provides a further complication in the comparison of crash data is the discrepancies between the number of registered vehicles and the number of vehicles observed on the roads in developing countries. Kayani et al. (2011), in a study of road safety in Pakistan, found the number of registered vehicles was half that of the actual vehicles on the road. Research by the Asian Development Bank (ADB) indicated that in some instances, the reported number of registered vehicles was more than the vehicles in use (ADB 2003). According to Mohan et al. (2009), probable explanations are that decommissioned vehicles were not removed from the databases, vehicle owners are not required to re-register their vehicles, or annual re-registrations are omitted from the databases.

Table 2.1 provides 2008 data on road network size, crash volumes, fatality rates, population size and gross national income (GNI) per capita for the APEC economies. These figures highlight the range of diversity within this group; population ranges from approximately 1325 million (China) to 0.4 million (Brunei Darussalam), GNI per capita ranges from approximately US\$48 000 (US) to US\$900 (Viet Nam) and growth rates range from 9.76 (Peru) to –1.10% (New Zealand). The rates of fatalities per 100 000 population, the measure generally recognised as the most appropriate indicator of a country’s road safety performance, vary considerably.

Table 2.1: Road fatality rates and associated statistics, APEC economies 2008

Economy	Total roads km	Road accidents (n)	Persons injured (n)	Fatalities (n)	Fatalities/ 100 000 people	Accidents/ 100 000 people	Population 2008	GNI per capita 2008 (US\$)
Australia	818 356	1 453	-	1 603	7.48	6.78	21 431 800	40 240
Brunei Darussalam	3 650	-	556	54	13.87	-	392 280	27 050
Canada	1 409 000	138 275	19 2196	2 754	8.27	415.1	33 311 400	43 640
Chile	79 604	-	65 301	1 782	10.6	-	16 803 952	9 370
China	3 730 164	265 204	304 919	73 484	5.55	20.02	1 324 655 000	2 940
Hong Kong, China	2 040	1 4576	18 522	162	2.32	208.89	6 977 700	31 560
Chinese Taipei	40 304	170 127	227 423	2 224	9.65	738.49	23 037 031	
Indonesia	437 759	59 164	79 171	20 188	8.88	26.02	227 345 082	1 880
Japan	1 200 858	766 147	945 504	5 155	4.04	599.94	127 704 000	38 130
Republic of Korea	104 237	215 822	338 962	5 870	12.08	444.01	48 607 000	21 530
Malaysia	109 333	373 047	-	6 527	24.16	1 380.92	27 014 337	7 250
Mexico	366 096	30 379	32 769	5 379	5.06	28.56	106 350 434	9 990
New Zealand	93 911	11 646	15 174	365	8.55	272.81	4 268 900	27 830
Papua New Guinea	19 600	-	1 210	237	3.75	-	6 576 822	1 040
Peru	102 887	32 854	49 857	3 510	12.31	115.24	28 836 700	3 990
Philippines	200 037	3 966	7 920	1 096	1.21	4.39	90 348 437	1 890
Russian Federation	963 000	218 000	270 900	29 900	21.06	153.58	141 950 000	9 660
Singapore	3 325	8 451	10 742	222	4.59	174.63	4 839 400	34 760
Thailand	180 053	111 035	83 438	12 609	19.87	175.01	67 386 383	3 670
United States	6 506 221	1 630 000	234 6000	37 261	12.25	536.08	304 060 000	47 930
Viet Nam	160 089	12 800	8 100	11 600	13.46	14.85	86 210 781	890

Source: IRF (2010).

The economies with the lowest fatality rates – the Philippines, Hong Kong China and Papua New Guinea – have very different environments. Hong Kong China is densely urbanised with heavy reliance on public transport. The Philippines and Papua/New Guinea have many islands; in the latter case, there is only one major inter-city road. Japan is a highly developed economy with an extensive road system, high levels of car ownership and a fatality rate which is close to the world's lowest for a developed country.

Malaysia, the Russian Federation and Thailand stand out as having particularly high fatality rates among the APEC economies. It should be noted that very little of the road transport activity in the Russian Federation actually occurs in the APEC region, most being concentrated around the centres of population in Europe. Both Malaysia and Thailand have very high rates of motorcycle travel which is a major factor in their high road fatality rates.

The data in the crashes per 100 000 population appears to be inconsistent. For example, the rate in Australia is slightly lower than the fatality rate, indicating that the rate is the rate for fatal crashes – sometimes, more than one person dies in a fatal crash. On the other hand, the rate for Malaysia is more than 50 times the fatality rate, indicating that the rate includes non-fatal crashes as well as

fatal crashes. Whether this rate is for fatal and serious injury crashes only, or whether it includes all injury crashes is not specified.

Heavy vehicles generally comprise a smaller proportion of the vehicles fleet than do passenger cars, while contributing to a larger proportion of the distance travelled. Trucks make up less than 1% of registered vehicles in Brunei, 3% in Canada, Thailand and Australia, 5% in Chile, Malaysia and Philippines, 10% in Peru, 15% in New Zealand and 18% in Papua New Guinea (WHO 2009).

Table 2.2 details the increases in registered heavy vehicles for APEC member economies between 2003 and 2008.

Table 2.2: Registered heavy vehicles (excluding buses), APEC economies 2003-2008

Economy	2003	2004	2005	2006	2007	2008
Australia	2 320 000	2 396 100	2 529 152	-	2 723 660	2 844 856
Brunei Darussalam	-	-	-	-	16 744*	-
Canada	588 774	-	-	-	742 5765	6 862 030
Chile	568 537	169 484	775 033	809 088	849 282	893 736
China	4 730 129	9 598 974	10 245 992	10 594 721	10 540 556	11 260 656
Hong Kong, China,	110 551	111 328	110 989	111 726	110 746	109 262
Chinese Taipei	885 780	919 269	953 470	971 801	975 650	973 671
Indonesia	2 047 022	2 315 779	2 920 828	3 541 800	4 845 937	5 146 674
Japan	18 550 958	18 360 433	32 967 000	33 722 000	34 324 000	34 739 000
Korea, Republic of	4 091 698	-	-	3 182 627	3 223 449	3 213 712
Malaysia	1 101 737	-	-	-	871 234	909 243
Mexico	6 491 489	6 707 535	7 111 172	-	7 849 491	8 453 051
New Zealand	415 867	429 120	444 023	455 696	465 803	478 336
Papua New Guinea	-	-	-	-	11 333*	-
Peru	415 019	418 977	446 242	-	486 285	534 061
Philippines	-	-	279 500	-	1 875 296*	-
Russian Federation	-	-	-	-	4 730 000	-
Singapore	135 333	137 316	139 098	144 466	150 979	156 089
Thailand	-	-	-	4 992 150	-	-
United States	94 943 551	100 016 691	103 818 838	-	110 497 239	108 025 731
Viet Nam	-	-	-	-	-	-

*Apparent error in original source. Figure in Table is ARRB team's assessment of probable fig

Source: IRF (2010).

Table 2.3 shows travel by heavy vehicles in the APEC economies. The United States has by far the greatest amount of travel by heavy vehicle, more than four times as much as China, the economy with the next greatest amount.

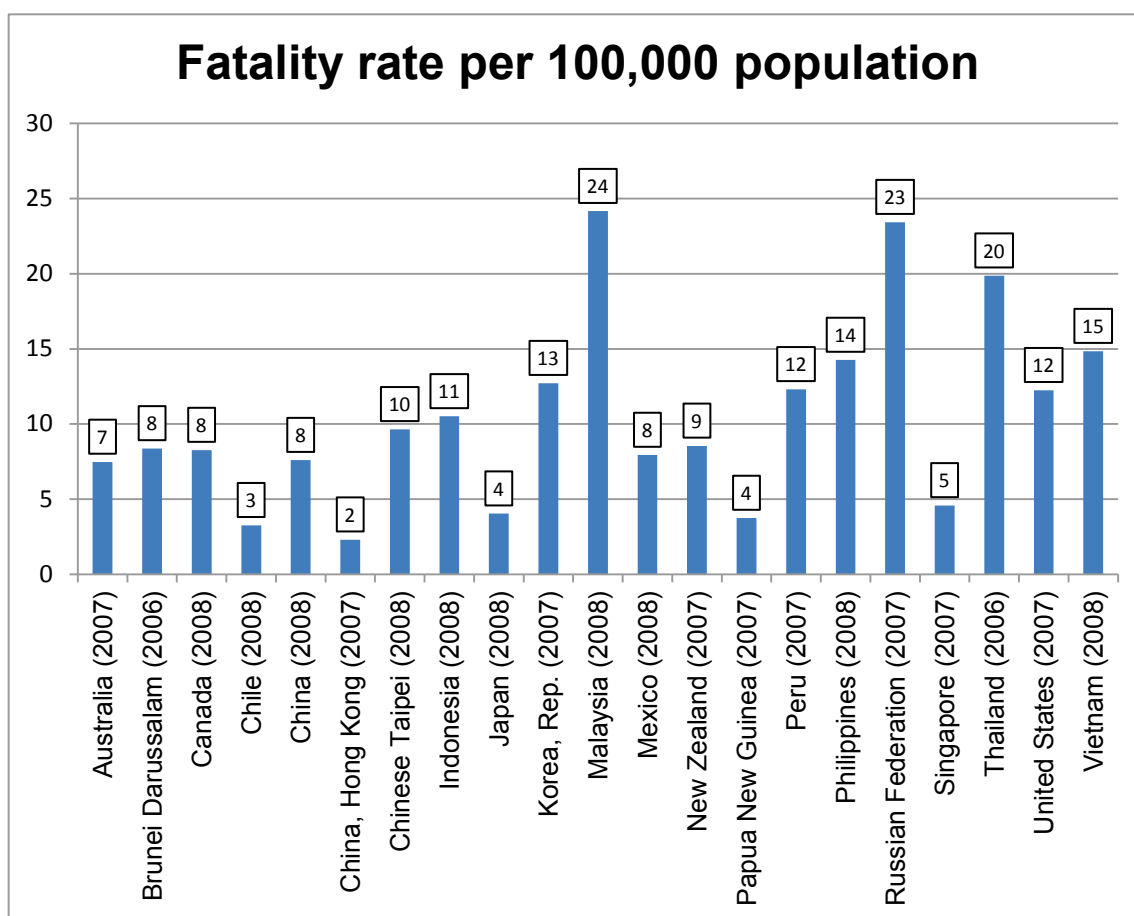
Table 2.3: Heavy vehicle annual vehicle-km (million) in APEC economies

Economy	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Australia	-	-	-	46 483	46 650	47 830	51 130	52 940	54 460	54 460
Canada	-	25 053	23 607	-	-	-	-	145 853	129 863	129 863
China	422 630	-	-	-	-	-	-	-	-	422 630
Hong Kong, China	3 253	-	-	4 090	4 044	-	-	-	-	4 044
Japan	260 846	257 636	254 968	257 000	248 728	-	241 849	-	-	241 849
Korea, Republic of	-	-	-	41 003	42 063	74 884	73 417	74 594	-	74 594
Mexico	-	-	-	13 332	14 289	14 649	17 774	20 108	21 280	21 280
New Zealand	5 900	6 100	-	-	2 811	2 939	-	2 776	2 660	2 660
Peru	5 840	6 205	-	22 344	-	-	-	-	-	22 344
Russian Federation	30 302	-	-	-	-	-	-	-	-	30 302
Singapore	-	-	4 563	3 987	4 047	4 389	4 582	4 375	4 884	4 884
United States				1 934 450	1 996 947	2 063 864		2 153 227	1 919 228	1 919 228

Note: Some economies omitted due to missing data.

Source: IRF (2010).

Figure 2.3 and Figure 2.4 show the fatality and injury rates per 100,000 population across APEC economies. Malaysia has the highest fatality and injury rates while Hong Kong, China has the lowest fatality rates. Note the extreme differences in injury rates. This probably indicates that different categories of injury are being reported.



Note: Caution must be applied in dealing with these statistics, for instance, the data for Australia appears to be inconsistent with the current statistics. The discrepancies are due to injury and fatality definitions and the data that is included in these measures.

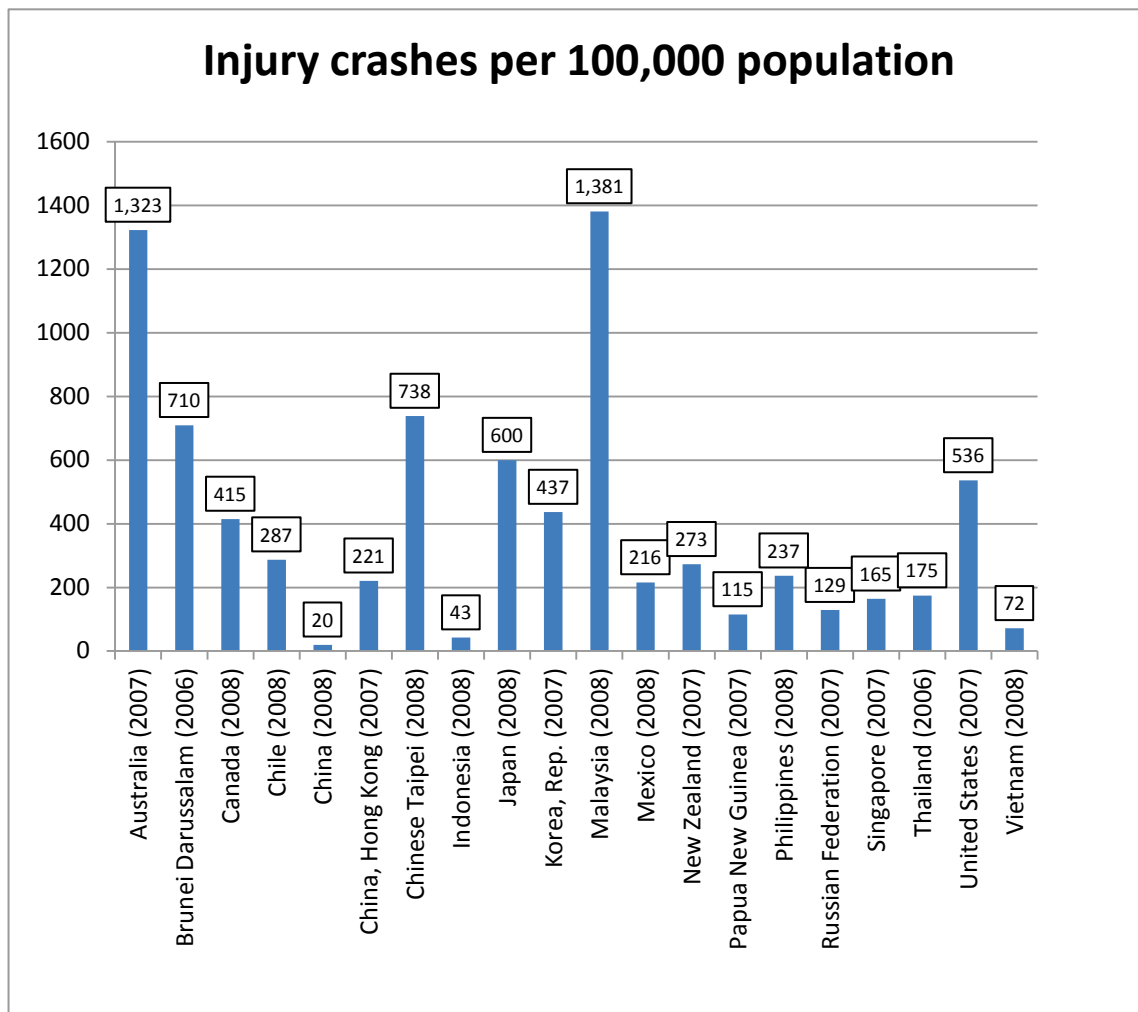
Data sourced from IRF (2010).

Figure 2.3: Fatality rate per 100 000 population

The increase in the heavy vehicle fleet, as well as overall vehicle ownership, across the APEC economies has led to increased diversity in traffic mix. This increase, along with the amount of travel by heavy vehicles and other factors, affects the severity and occurrence of crashes.

Table 2.4 to Table 2.7 outline the nature of heavy vehicle crashes in APEC economies. As there is limited data available, only a handful of the members are represented. The reported data also includes information extracted from the survey that was undertaken as part of the current research.

Table 2.4 outlines data on heavy vehicles involved in fatal crashes. The figures are higher for Thailand and the United States while considerably lower for New Zealand. The data shows a general reduction in crashes for Australia, Hong Kong China, United States, Singapore and New Zealand, with Korea experiencing the greatest reduction. There was an increase in fatal crashes in Thailand.



Notes: Brackets represent latest year. Caution must be applied in dealing with these statistics, for instance, the data for Australia appears to be inconsistent with the current statistics. The discrepancies are due to injury and fatality definitions and the data that is included in these measures. The data was obtained from IRF (2010). Data sourced from IRF (2010).

Figure 2.4: Injury crashes per 100,000 population

Table 2.4: Heavy vehicles involved in fatal crashes

Economy	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Australia	-	-	242	208	230	210	217	227	217	192	197
Hong Kong, China	1217	1185	1249	1108	1197	1180	1155	1081	1045	907	-
Japan*										2009	
Korea, Republic of	2243	2485	1973	1873	1793	1659	1452	1331	1270	1170	-
Malaysia*											202
New Zealand	75	76	69	62	80	72	76	68	53	51	-
Singapore	-	51	40	35	47	42	34	47	45	58	47
Thailand	6404	6364	7743	-	-	-	-	-	-	-	-
United States	4995	4823	4587	4721	4902	4951	4766	4633	4089	3215	-

Notes: *Data extracted from questionnaire.

Source: Korea – Road Traffic Authority (2009); Singapore – Singapore Police Force (2010); Hong Kong, China – Transport Department (2010); United States – National Highway Traffic Safety Administration (FARS); New Zealand- Ministry of Transport (2010); Thailand – Tanaboriboon and Satiennam (2005); Australia – Department of Infrastructure and Transport Fatal Road Crash Database.

Table 2.5 outlines heavy vehicle fatalities by vehicle occupants (both drivers and passengers). The data follows a similar downward trend to Table 2.4. The major change was observed in the United States with the rest of the economies maintaining constant levels.

Table 2.5: Heavy vehicle driver and passenger fatalities

Economy	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Canada	-	71	87	107	91	84 (3%)	-	-	-	-	-
Malaysia	-	-	-	74	91	84	107	110	99 (2%)	-	-
New Zealand	16	13	13	16	19	21	15	10	7	7 (2%)	-
Singapore	-	7	3	5	6	7	9	7	5	8	9 (5%)
United States	754	708	689	726	766	804	805	805	682	503 (1%)	-

Notes: Number in brackets indicate heavy vehicle fatalities as a percentage of the road toll for latest year for which data is available

Source: Canada – Transport Canada; Singapore – Singapore Police Force (2010); United States – National Highway Traffic Safety Administration (FARS); New Zealand – Ministry of Transport (2010); Malaysia – Malaysia Road Accidents and Deaths Statistics; Australia – Department of Infrastructure and Transport Fatal Road Crash Database.

The number of heavy vehicle occupant fatalities is considerably less than the number of fatal crashes involving heavy vehicles. The mass of the heavy vehicle protects its occupants in crashes, but inflicts large impact forces on other road users in collisions, with the result that there is a much higher probability of other road users being killed.

Truck occupants constituted between 1% and 3% of the fatalities in the economies listed in Table 2.5, with the exception of Singapore where they were 5%. However, it is generally other road users, not the truck occupants, who are generally killed or injured in truck crashes.

Table 2.6 provides data on heavy vehicle crashes that resulted in injuries and death. The data is not restricted to heavy vehicle occupants. There was an increase in casualty crashes in Canada and an overall reduction for the rest of the economies. Malaysia experienced the greatest reduction over the reported period.

Table 2.6: Deaths and injuries resulting from heavy vehicle crashes

Economy	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Canada	-	1628	1733	1768	1837	1995	-	-	-	-	-
Malaysia	-	-	-	1010	1092	1077	942	785	739	-	-
New Zealand	854	1008	1096	1073	1214	1225	1227	1250	1219	951	-
Papua New Guinea	-	-	-	-	-	-	-	345	-	-	-
Singapore	-	456	412	318	372	332	401	470	530	407	577

Notes: * Data extracted from questionnaire.

Source: Canada – Transport Canada; Singapore – Singapore Police Force (2010); New Zealand – Ministry of Transport (2010); Malaysia – Malaysia Road Accidents and Deaths Statistics; Papua New Guinea – National Road Safety Council (2011).

Table 2.7 shows the number of heavy vehicles involved in injury crashes. The data shows a reduction for the United States and relatively smaller increases for Singapore and New Zealand. The differences could be attributed to reporting inconsistencies associated with injury types.

Table 2.7: Heavy vehicles involved in fatal and injury crashes

Economy	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Japan*	-	-	-	-	-	-	-	-	-	1 791	-
Malaysia*	-	-	-	-	-	-	-	-	-	-	162
New Zealand	545	620	746	765	829	837	806	871	889	666	-
Singapore	-	1 025	980	852	967	847	1 016	1 099	1 242	1 147	1 292
United States	101 000	90 000	94 000	89 000	87 000	82 000	80 000	76 000	66 000	53 000	-

Notes: * Data extracted from questionnaire.

Source: Singapore – Singapore Police Force (2010); United States – National Highway Traffic Safety Administration (FARS); New Zealand - Ministry of Transport (2010).

2.2.2 The extent of truck crashes in the APEC economies

The extent of the truck crash problem in APEC economies is of key interest for policy decision makers. Unfortunately, comprehensive data is not available. Estimating the number of truck crashes in the APEC economies must therefore rely on extrapolating from the available data sources. This process inevitably ignores possible differences in the definitions applying in different economies and can do no more than produce tentative estimates.

Combining the number of deaths and injuries from Table 2.6 with the numbers of trucks on register from Table 2.2, using the most recent data available in both cases, produces estimates of the number of deaths and injuries per 10,000 registered trucks. These ranged from 2.7 deaths and injuries per 10,000 trucks for Canada to 38.2 for Singapore¹. The middle of the range is approximately 20 per 10,000 vehicles; this was taken as an estimate of the average rate.

The total number of trucks on register in the APEC economies in 2008 was approximately 205 million (Table 2.2); allowing for the missing table entry for Viet Nam and some growth in the fleet,

¹ The rate in PNG was 302 per 10,000 populations, well outside the range of the other economies. As mentioned in the Section 2.2.1, PNG's transport scene is differs considerably from those of other economies and so was not considered for the purposes of estimating an overall number.

the current number of trucks may be estimated at approximately 210 million. Applying the estimated average rate of 20 fatalities and injuries per 10,000 vehicles to this total produces an estimate of 420,000 deaths and injuries per year for the APEC economies. It is emphasised that this is a tenuous estimate.

2.2.3 Nature of the truck safety problem in developing economies

There is relatively little published data regarding the nature of the heavy vehicle road safety problem in APEC economies. In a paper designed to set the scene for a major workshop on heavy vehicle safety, Vulcan (2002) examined how truck crash rates in the Australian trucking industry compared with rates in other comparable countries. In terms of fatal truck crashes per population, Australia's position is in the approximate middle of the range of developed countries, slightly higher than the USA or Canada, similar to Germany, and lower than New Zealand.

Vulcan identified the following list of factors which influence truck crash rates:

- Human factors – driver fatigue, driver education, speeding, awareness of road safety issues, impaired driving, work schedule and expectations, skills shortages.
- Vehicle factors – loading, load balancing, roadworthiness, technology, safety features, maintenance.
- Infrastructure – road type and speed limit, road features.
- Legislation and regulation – road safety guides for truck drivers, instruction manuals, vehicle and cross-border legislation and enforcement.

He also discussed other aspects of truck crashes, including social costs of crashes, infrastructure damage, impact on health system and cross border issues.

Vulcan made the following recommendations for improving truck safety in Australia:

- Little difference was found among the various vehicle configurations but there were substantial differences between different road types. It is therefore more effective to treat the road system – especially by providing divided roads – than to restrict the types of vehicle.
- The higher proportion of night-time crashes, particularly single-vehicle crashes, suggests that it would be worth reconsidering the extent to which operations could be re-scheduled to avoid night-time operations, or to consider how fatigue could be managed more effectively.
- Front and rear under-run protection is required to protect other road users; truck occupants would benefit from higher seat-belt wearing rates.
- Consideration should be given to adopting speed limits that better manage the risks of the road and traffic environment for trucks.

Uddin and Hoque (2003) is particularly relevant as it provides an overview of the issues faced by heavy vehicle drivers in Bangladesh. Interviews were conducted with 200 bus drivers and 150 truck drivers, based on 10 major terminals distributed throughout Bangladesh. Although its driver population is not drawn from the supply chain sector, it does give some useful insights into the general state of driver conditions and training in the wider industry.

Drivers had between 1 and 30 years' driving experience. Forty per cent had no formal education, 40% had only primary education, and the rest had completed secondary schooling, but only a few had the opportunity to pass the certificate at the end of secondary schooling. Recruitment was largely through a loose industry experience approach, with 50% having worked as a driver's assistant or conductor, and 45% having worked in a vehicle repair shop before driving.

Only a small proportion of drivers were employed on a regular basis. Most were engaged for an individual trip, on the basis of a verbal agreement. Only about 1% had received formal driver training; 70% were carrying fake licences. Some appeared to be not even aware that their licences were fake. Forty per cent of licences (presumably the authors mean valid licences) were obtained by bribery.

Not surprisingly, better educated and more experienced drivers understood driving situations better, and reported better driving behaviour. Ninety per cent of drivers could not explain the difference between triangular (warning e.g. curve) and round (regulatory e.g. speed limit or pedestrian crossing) signs, and 75% could not identify important road markings. Approximately 80% did not understand the relationship between safe following distance and speed, most thinking it was the same for all speeds.

Attitudes and opinions about driving conditions also gave cause for concern. Rules were disobeyed when they did not seem necessary, e.g. driving at high speed when traffic conditions permit, and disobeying traffic signals in low volume conditions at night. The prevailing view was that the largest sized vehicles should get priority and that there was no need to drive cooperatively with smaller vehicles. Seventy-five per cent of drivers reported making illegal overtaking manoeuvres to fulfil trip schedules, and 95% said overloading was common practice. Speedometers did not work in 75% of the vehicles, and 40% did not have functioning windshield wipers.

Understanding the problem is pivotal to improving safety outcomes and developing a coordinated mitigation approach involving all key stakeholders in the logistics sector. This section has provided insight into the scale and nature of the heavy vehicle safety problem in both developing and developed APEC member economies to assist in developing an evidence-based approach. However, the literature review also highlights data constraints, reporting inconsistencies and limited research at both a global level and within APEC economies.

3 QUESTIONNAIRE

This section provides a summary of the findings of the questionnaire. The actual questions asked and the replies received are documented in Appendix C, together with some brief comment from the project team on the patterns of responses.

The questionnaire was developed in close consultation with the client, and distributed to economies on 19 May 2011. Attendees at the APEC Transportation Working Group meeting in June were reminded of the importance of completing the questionnaire, and a further email reminder was sent on 5 July.

Despite these reminders, only six replies were received. Although the low response rate limits what can be said about the road transport industry across APEC, the responses do provide an interesting cross-section which provides some insights into the status of truck safety across the economies.

The main conclusions which could be drawn from the answers to the questionnaire are summarised below.

1. The composition of truck fleets, in terms of the relative number of rigid and articulated trucks, varies considerably across economies. Arrangements for limiting weights and dimensions also differ from economy to economy; axle load limits in particular are complex and varied.
2. Maximum permitted speeds depend on the road network and vary considerably between economies, with Viet Nam and the Philippines having low maximum permitted speeds. Only Viet Nam has different limits for articulated and rigid trucks.
3. Most of the economies that replied to the questionnaire have a reasonably comprehensive framework of regulations in place, covering maximum loads, vehicle maintenance standards, and load security. Two economies did not have regulations covering driving hours, driver logbooks and the transport of dangerous goods.
4. Both Australia and New Zealand have graduated licensing arrangements for truck drivers, with drivers required to obtain experience on smaller vehicles before progressing to larger vehicles. Other economies have experience requirements, but they appear to be less demanding.
5. Most jurisdictions allow drivers to hold a car licence at age 17–18. Some allow a rigid truck licence at a similar age. Most require drivers to be 21 years old before they can hold an articulated truck licence, 24 years old in the case of Viet Nam, and 25 years old in the case of Australia.
6. In most jurisdictions, enforcement responsibilities are shared between the road authorities and the police. Some economies have a direct role for the occupational health and safety authority.
7. Most jurisdictions have at least one body which represents the industry. Often, there are organisations that represent the logistics sector and shippers which could also be influential in the present context.
8. Australia, Japan and New Zealand appear to have been particularly active in pursuing programs to improve heavy vehicle safety. These include improvements in driving standards, regulation of driving hours, safety management in companies, safety equipment on trucks, the enforcement of safety regulations, and the safety of the road environment for trucks.
9. Malaysia has published a wide range of documents dealing with general occupational health and safety matters, fatigue, and driving at high-risk times for fatigue crashes. Australia,

Japan and New Zealand have also published material relating to driver health and fatigue, while Japan has published material on safe transport of containers and effective use of on-board recording devices.

10. Most jurisdictions are able to provide data on fatal and serious injury crashes, separately for rigid trucks and articulated trucks; only Australia and New Zealand can provide a breakdown by gender of the persons killed or injured. Note that Australia can only do the latter on a state - by-state basis due to inconsistencies in the classification of injury crashes.
11. A range of safety concerns was identified in different economies. No publications detailing safety concerns were received.
12. Japan was the only economy which indicated it did not have an estimate of the total cost of road crashes. The percentage of GDP indicated for the Philippines and Viet Nam (1.7% and 2% respectively) is consistent with the percentage of GDP in Australia (2%).
13. Australia and New Zealand have estimates of crash costs per fatal or serious injury crash, and Malaysia has estimates of costs per fatality or serious injury.
14. Australia has an estimate of the relative cost of truck crashes compared to other crashes; only New Zealand has an estimate for the total cost of truck crashes to the country. This appears to be equivalent to approximately 0.3% of GDP.
15. Low driver skills, poor maintenance, driver fatigue, and overloading were regarded as high priority issues by all respondents, attracting consistent ratings of high priorities. Drug use and insufficient provision for trucks on both major and minor roads, and poor road maintenance were rated as issues which were lower priority, generally attracting a mixture of high and medium priorities. Bad behaviour of other road users was generally not seen as a priority issue. One economy volunteered 'bad driving attitude' as a priority.
16. Only Malaysia reported on measures to deal with cross-border issues. Four of the respondents were island nations where border-crossing issues would not arise.

4 VISITS TO APEC ECONOMIES

This section documents Task 3, a program of visits to Malaysia, Thailand and Viet Nam undertaken in July 2011 to ascertain the issues associated with heavy vehicles in these economies, the priorities attached to these issues and whether any innovative programs which might be suitable for inclusion in the compendium had been undertaken. Government and private sector stakeholders were consulted in all three economies.

Similar problems were found in all three economies. The most pressing problems for the road transport industry are overloading and a large number of older, less-capable vehicles. However, for trucks in the logistic supply chain, the main issues are:

- availability of well-qualified drivers, with a good understanding of their responsibilities and the risk factors associated with truck driving
- better management of fatigue, extending beyond driving hours to include life-style factors
- more extensive use of on-board tracking devices to monitor drivers and speeds; coupled with this there was a need to teach companies how to make best use of the information the systems provided to improve their business performance.

The findings from the program of visits guided the two remaining project tasks: the literature review and a compendium of appropriate road safety measures.

Visits to government agencies were organised by the Project Overseer within the Department of Infrastructure and Transport in Canberra. A number of complementary visits to the private sector were also organised through ARRB's existing contacts in the region. Organisations were contacted and provided with an explanation of the project and an outline of the desired outcomes of the meeting prior to the visit. The discussions with each stakeholder group are summarised in the following sections, split up according to the economy in which they were located.

4.1 Visits in Malaysia

Visits in Malaysia included the following organisations:

- Road Safety Department within Malaysia's Ministry of Transport
- Land Public Transport Commission
- Royal Malaysian Police
- PUSPAKOM (the body in charge of conducting vehicle inspections)
- Malaysian Institute for Road Safety (MIROS)
- Public Works Department
- Occupational Health and Safety Department
- Road Transport Department
- Lee Automotive (involved in heavy vehicle maintenance)
- Malaysian division of Linfox.

4.1.1 Ministry of Transport – Road Safety Department

The meeting with the Ministry of Transport was with officials from government agencies that are stakeholders in heavy vehicle safety. The meeting commenced with a general session in which the Director-General of Road Safety, Datuk Suret Singh, explained recent developments in road safety

in Malaysia, and ARRB explained the background to the project and the objectives of the consultation. This was followed by a series of separate sessions where the role and concerns of individual agencies were discussed in some detail. Further notes are provided below.

General session

Datuk Suret Singh began by explaining the status of the current Malaysian Road Safety Plan. It was driven by Vision Zero (to achieve zero fatalities and serious injuries over time), and recognised the critical importance of partnerships in achieving this. A number of important partnerships were already in place; with Occupational Health and Safety (OH&S) for a code of practice for heavy vehicle operation; with Petronas (national oil company) for participation in road safety education; and with an insurance company for defensive driving programs.

In all, 35 companies had signed a memorandum of understanding for the involvement in road safety activities. There are a number of significant developments in Malaysia. These included:

- Education – a program of school-based road safety education had been developed and teachers had been trained in delivery. An evaluation study had just been completed, which was able to compare the effects of one, two and three years' exposure to road safety education.
- Speed cameras – the legislation was in place, and camera enforcement was expected to begin about the end of 2011, using both fixed and movable cameras.
- Road engineering – iRAP surveys had been carried out and the results were now part of policy guidelines.
- Vehicle engineering – The United Nations Economic Commission for Europe (UNECE) requirements relating to vehicle standards were in the process of progressive implementation, and were due to be fully implemented by 2015.
- Fleet safety – a code of practice had been developed over a period of years, and taken up by some operators on a voluntary basis. Recent legislation was going to make this compulsory in the near future.
- Licencing – the Public Transport Commission had been in operation for only a short period; legislation requiring transport operators to be licensed had recently been passed which was expected to make a major difference to compliance in all areas, including safety.
- Evaluation – the importance of evidence-based action was well accepted, and the role of the universities, the Malaysian Institute for Road Safety (MIROS) in particular, was highly regarded.

While the core business of the road safety division was education, its other key role was in coordinating the road safety activities of the other stakeholders. Its work was greatly facilitated by the developments of Vision Zero, UNECE and the OH&S code of practice. The policies and goals are now clearly defined, and much was expected from the current 10-year plan. It had moved from the 'Haddon matrix'-inspired approach to an outcome approach, with the individual stakeholders responsible for determining how the outcomes were to be achieved. Partnerships and shared responsibilities were the key focus.

Dr Peter Cairney then gave a presentation to introduce the project. He began with a brief introduction of himself and his experience in the region, introduced ARRB and its work, with emphasis on projects with which the audience might be familiar, and then introduced the project. The background and objectives were explained, followed by an explanation of the tasks involved, and a status report covering the work done so far. The session concluded with an explanation of what it was hoped to deliver in the compendium.

4.1.2 Land Public Transport Commission and Royal Malaysian Police

These meetings were conducted in the presence of Messrs. Hanif, Yusfryah and Sharif (Land Transport Authority); Superintendent Goh (Royal Malaysian Police); and Mr. Vejay (Ministry of Transport).

The Land Public Transport Commission (Suruhanjaya Pengangkutan Awam Darat (SPAD) in Malay) is a newly-established organisation, commencing operation in February 2011. It was responsible for the licensing of operators in the land transport sector (including both rail and road). It has taken over the vehicle licensing function of the former Commercial Vehicle Licensing Board. A new Public Transport Act will come into force in 2012, which will require truck operators to be licensed. Three categories of truck operator licence were available:

- Class A – line operations, normal commercial operations
- Class C – for carriage of the business's own goods
- Class KA – other.

There has been no opportunity to test operator reaction to or compliance with these licensing requirements as yet.

The SPAD is also responsible for determining standards for commercial vehicles. Although the current construction and use rules have been in force since 1959, with successive amendments, standards are being upgraded. Under an ASEAN agreement, progress was being made to roll out all 17 UNECE regulations by the end of 2015. This would ensure that new vehicles coming into the fleet would be of a much higher standard than in the past. Up to the present time, as far as vehicle defects were concerned, the biggest priority was to address defects on buses. Brakes and lighting tended to be the biggest issues; rear reflectors were also a major issue for trucks, with many crashes resulting from collisions with stationary trucks at night.

Second- hand and non-genuine spare parts were also noted to be major issues – the performance of these components could not be guaranteed. There was a need to introduce standards for spare parts – this had already been done successfully for tyres. However, the quality of re-treads (re-manufactured tyres) tended to be an ongoing issue.

The main concern with the opening of the borders under arrangements for the ASEAN Economic Community by 2015 was the urgent need for a policy on the movement of hazardous goods. Some progress had been made on this, but more work was needed to have a harmonized policy in place when the agreement came into force. One of the main gaps at present was route selection and incident management plans – without these, the situation in an emergency would be chaotic.

The function of the traffic police was to check the use of vehicles on the road. This had now become more focused. Road safety campaigns had previously been a police responsibility, but this function had been taken over by the Road Safety Department.

Crash investigations were an important function; the results were shared with other relevant agencies. Speeding was the major issue which the police dealt with. Overloading was also a major safety problem. If police observed that a truck appeared to be overloaded (overloaded to a level at which it became obvious to a casual observer), they would direct the truck to a weighing station (operated by the Public Works Department) for an accurate assessment of the load.

It was noted that poor maintenance contributed directly to crashes, but it also had a major impact in that vehicle breakdowns created hazardous traffic situations and contributed to delays and congestion. Reflectorised hazard warning signs were required to be carried and placed some

distance in advance of the vehicle, but compliance with and enforcement of this requirement was low.

Driving hours were a problem and compliance was not a police responsibility. There were occasional checks for drugs amongst truck drivers; however, drugs were believed to be a much greater issue for motorcyclists. The shortage of drivers contributed to pressure on drivers to speed and exceed driving hours. A few women were now being employed in the industry as coach drivers. At present, there is no legislation regarding the maximum life of a truck. This means there are many old vehicles on the road.

4.1.3 PUSPAKOM – Vehicle Inspections

Puskapom is a government-approved vehicle inspection service in Malaysia. It is responsible for the inspections for all private vehicles and heavy vehicles. The meeting was held with Messrs Ramasamy and Haji Yacob.

For commercial vehicles, two types of inspection are required:

- an initial inspection, when the vehicle is first registered or when the vehicle changes ownership
- a regular inspection (annually for the first two years, six-monthly thereafter).

The initial inspection is to establish that the vehicle complies with the design and construction rules. One of the checks is to ensure compliance in terms of dimensions. Many different types of special-purpose body types are in use, and these are often fitted to imported second-hand trucks. Currently permitted dimensions are 12 m for a rigid truck, 16 m for an articulated truck, and a 51 tonne gross combined mass.

For regular inspections, an annual inspection was required for the first two years, then an inspection every six months after that. PUSPAKOM carried out approximately three million heavy vehicle checks per year. The organisation comprises 72 centres, 50 of them equipped with computerised equipment. Some of the smaller stations in remote areas were only in operation two or three instances per month.

Some of the issues noted during the vehicle inspections were:

- Smoke emission test results could be unreliable as additives were sometimes used to suppress exhaust smoke during testing.
- Many different types of brake testing equipment were currently in use (the majority being sourced from Muller-Behr in France).
- Larger fleets generally had scheduled maintenance programs and had few problems with inspections.
- Tyre substitution for the inspections was believed to be common, but difficult to prove. New tyres were required for the steering axle; re-treads were permitted on the other axles.
- Substitution of other equipment in order to pass the inspection may also occur. PUSPAKOM could only assess the vehicle in the condition in which it was submitted for inspection.
- Seat belt wearing was not compulsory for vehicles weighing more than 3.5 tonnes; it was compulsory for bus drivers (also the front passengers) and drivers of vehicles less than 3.5 tonnes. Seat belts were therefore not required in large vehicles.

Speed limiting technology had been tried in the past, but had been withdrawn as it was considered impractical due to tampering. An on-board speed detector caused a flashing light on top of the vehicle to operate to draw attention to enforcement authorities. At present, many companies had fitted GPS-based equipment to monitor their drivers but the results were not considered reliable.

Vehicle examiners were noted to be well-qualified, holding automotive certificates from colleges and receiving in-house training.

4.1.4 Malaysian Institute for Road Safety (MIROS)

The meeting was conducted with Mr Huzifah from the Crash Safety Engineering Unit and Mr Syezwan of the Crash Reconstruction Unit. They outlined an extensive program of research into heavy vehicle issues; few research outcomes were available at the moment, but many studies were either awaiting publication or at an advanced stage of report preparation. Other key studies included:

- An on-scene investigation of heavy vehicle crashes was under way, involving reconstruction of crashes.
- A study of the effectiveness of under-run protection, based on the case-control method, had been completed and was awaiting publication (under-run protection was required in trucks weighing more than 5 tonnes but was optional for smaller vehicles).
- A study into vehicle compatibility had also been completed but had not yet been published. It was concerned with crashes between heavy vehicles and passenger cars, and focused on the relationship between the ratio of the masses and crash severity.
- A study into vehicle overloading had reached the stage where data collection was complete, but the full report was still being completed.
- A study of sleep apnoea in commercial bus drivers (based on a questionnaire survey) had recently been completed and was available on the website.

A study of crashes involving commercial vehicles at night (between midnight and 6 am) was due to be published shortly. It was proposed to focus on conspicuity issues as well as only crashes into stationary vehicles. Speed differentials were such that vehicles were running into the rear of moving trucks. It was noted that the oldest trucks are likely to have the greatest speed differential with other vehicles, and are likely to have the poorest lighting and reflective treatments.

MIROS was also involved in vehicle crashworthiness research. To date, assessments were based on crash tests conducted by laboratories in other countries and other secondary sources. Crash testing for the Malaysian Vehicle Assessment Program (MyVAP) was proposed to commence in 2012. There were plans to include crash tests with under-run protection. MIROS had also been involved in developing the Guide to Safety, Health and Environment, for the Transport Industry Occupational Health and Safety Code.

4.1.5 Public Works Department

The meeting was with Mr Amar Ahmoud and Mr Harizan from the Road Safety Unit, and Mr Fahmid from the Road Design Office. The following key issues and actions were noted:

- Trucks were not seen as a major road safety concern, as priorities lay with motorcyclists and pedestrians.
- Motorcycle lanes had been one of the big projects in recent years.
- Bridges were beginning to emerge as an issue as more and heavier trucks used the road system.

- A program to reinforce or reconstruct trucks as required was under way.
- Major activities involved provision of pedestrian bridges, signalling intersections, and curve improvement.
- Truck parking is a problem; there are not enough parking facilities. Where trucks are parked in or near residential areas, angry reactions on the part of residents can occur. On the road, there are few rest areas which are suitable for trucks.

The concept of a 'design vehicle' was well established and not thought likely to change. However, compliance with standards was a major issue. The main road system was designed to handle large trucks, so they were not an issue on these roads. However, it was recognised that distribution points were needed where large loads could be split amongst smaller vehicles for final delivery on local roads.

Highway 7 had been explicitly designed to handle large trucks; although the design standards exceeded what was currently required, it was believed that this is what would be needed for the future. Manoeuvring large vehicles on the current road system was a concern, particularly performing turns in urbanised areas, and performing U-turns. Some over-dimension Scania buses have been acquired, but they are able to run only on selected routes where the road geometry accommodates them. Road width is a major problem, as narrow roads experience problems in the form of loss of the pavement edge, requiring ongoing maintenance.

Traffic barriers are designed to restrain an 8 tonne vehicle travelling at 60 km/h. Mostly guardrail-type barriers are used, along with some wire rope barriers and some concrete barriers. Theft of guardrail is a major problem, stolen for its scrap value.

Some overtaking lanes have been constructed, but many more are required. Slow trucks (especially on hills) cause frustration among other drivers. More overtaking lanes may be a viable solution to cater for increased truck numbers. In other circumstances, trucks are able to travel at high speeds, and this poses a risk to other road users. From the road authority point of view, some form of speed limiting would be welcome.

The biggest issues posed by trucks are:

- Access to industrial areas. Entrances and exits to and from factories are often not designed for trucks; these need to cater better for trucks to avoid causing delays to other road users and the creation of high-risk situations when trucks are entering or leaving premises.
- Weight issues. Apart from the overloading issue, long steep grades even on some expressways were resulting in additional weight restrictions. In extreme cases, there was some risk of burning out the transmission.
- To avoid congested intersections, trucks take shortcuts through residential areas, using roads which are not suited to them. Construction of overpasses would help resolve this issue.

There were no special programs to upgrade roads for trucks at present. However, current policy was that if a traffic study indicated the likely volume of the road exceeded 25 000 AADT, then the road had to be designed to cater for large trucks. Previously, trucks had not been considered in the selection of road standards.

4.1.6 Occupational Health and Safety Department

The Occupational Health and Safety (OH&S) Department conducted health and safety audits of workplaces and awarded a grade according to their level of compliance with the Code. The

process started with bus operators in 2008, and was extending to the entire transport sector from 2009 onwards, starting with 157 audits in 2008, and over 400 audits carried out in 2010.

Where breaches were detected, notices were issued and improvements required. All companies with more than 5 employees were required to have a written policy. There were noted to be large gaps between large companies and small operators. The petroleum industry was particularly active in promoting safety. The cooperation of MIROS and UITM (University of Technology MARA) were acknowledged in developing the Code.

Low awareness of issues and of the risks of certain behaviours and their consequences were key problems. In the context of the Code itself, people needed to learn what was expected of them. The new SPAD organisation (Land Public Transport Commission) created opportunities to influence safety-related behaviours, because the OH&S performance of the organization was one of the factors to be considered when considering registration of transport operators. Close cooperation between the OHS, Department and SPAD was listed as a key requirement in creating a functional system.

Community crashes (journey to work crashes) were noted to be a major problem, accounting for approximately 40% of occupational injuries. Back pain for bus drivers was also a concern, and was currently being researched. Drivers of buses and large trucks had a compulsory medical examination each year. These were required to be conducted by a doctor in a government hospital. Nevertheless, there appeared to be some problems with unfit drivers managing to pass the test; however, further information was not available.

Close future coordination with SPAD had the potential to drive considerable improvements in the industry's occupational health and safety performance. The key tools for this were:

- the audit program
- the performance rating
- the link to the conditions for operator registration
- a system of national awards for outstanding safety performance in different categories.

4.1.7 Road Transport Department

Participating in the meeting were Mr Azan Zufrij from the Licensing Division, Ms Akita and Mr Mustoran Bin Haiza of the Automotive Engineering Division, Ms Sarah from the Driver Standards Division, Mr Hafriziz from the Land Division Coordinating Committee, Mr Maid from the Vehicle Assessing Division, and Mr Aludin from the Registration and Licensing Division.

An agreed ASEAN framework was in place for closer economic cooperation. This was a cumulative process, beginning with an agreement about transit across third countries, a multi-modal agreement covering all transport modes, and leading to agreements between individual countries. An agreement covering ASEAN-wide movements had yet to be reached. This enhanced mobility and raised a number of safety concerns, including:

- There were no proper guidelines regarding the movement of hazardous goods; rules and procedures differed between countries. Insurance arrangements were not yet harmonised – this was an issue for the industry and the central banks.
- There were also issues of vehicle compatibility, such as maximum vehicle width and weight – 51 tonnes was the limit in Malaysia; however, overloading was endemic in the industry and there were dilemmas about how to bring this under control.

- The vehicle fleet varied from country to country, and safety and inspection standards may not be the same. East Malaysia was identified as a problem area, with Indonesian trucks making cross-border movements. Left-hand drive was mentioned as a potential issue (but note that the prevailing industry view is that where this is an issue, prime movers will be exchanged at the border).
- Because border crossing was intended to be as efficient as possible, containers were not routinely opened at border crossings, which left the possibility opened for undeclared shipments of hazardous goods.
- Partnered driving was preferred for long trips, but this could not be enforced, and the shortage of skilled drivers made this difficult to achieve. It had been proposed to address driver shortages by means of a driver training institute; however, this had stalled through lack of industry support.

Drivers also remained a problem. At present there was no age limit for truck driving. The current licensing requirements were that the driver must be at least 21 years old and to have held a D class (car) licence for at least one year. They could then pass a test to hold an E class (truck) licence – different licences were required for rigid and articulated trucks.

Truck licences were renewed yearly, subject to passing a medical examination which could only be conducted by a doctor in a government hospital. Driver performance was monitored through a demerit points system (more points being deducted for more serious offences), with the licence being suspended once the threshold had been reached.

Enforcement was set to change radically at the beginning of 2012, with the Road Transport Act coming in to force, and a new organisation to enforce it. Operator licensing made all the difference, as it could bring together the company's record on loading offences, vehicle roadworthiness, traffic offences committed by drivers, and occupational health and safety performance. This could be a big initiative for cultural change within organisations.

Overloading was recognised as a big issue. Containers were not thought to be an issue, as their weight was considered to be well-regulated by the maritime industry. The main offender regarding overloading was the construction industry, where there was often strong pressures to get the job finished as quickly as possible, and trips tended to be of fairly short duration. Coupled with the ageing vehicle fleet, overloading was believed to be a considerable safety issue. A suitable policy on the maximum permissible age of vehicles would help relieve this.

4.1.8 Meeting at Lee Automotive, Shah Alam

A meeting had been arranged with Mr Lee, who manages a branch of an automotive company which specialises in the maintenance of Scania trucks; one of his customers, Captain Khoo, volunteered to attend when he heard about the project.

Captain Khoo owns and manages a fleet of 22 trucks, a mixture of rigid and articulated trucks, and specialises in the transport of bulk liquids, including liquid gas. Safety and reliability are of prime importance to the organisation; all his vehicles are Scania's, regularly serviced according to the manufacturer's recommendations by Lee's business. Many safety issues are associated with articulated trucks in particular. As each vehicle represents a considerable outlay, it was considered to be worth taking care of them. The four key elements in the context of the operational side of the business were the vehicle, the driver, the journey and the environment.

Each of these was a management responsibility – the vehicle was not an issue in this part of the industry, but managing the driver was. Fortunately the company was small; the manager could

know all his drivers well and make sure they were well looked after. Because of this, drivers tended to stick with the company. The company paid market rates – between 1500 and 4500 ringgit per month, according to experience and responsibility.

It was the opinion of those interviewed that the government was not helping enough with safety advice, as the company had to rely on the industry to provide guidelines. The possibility of setting up a training scheme had been looked at by the industry, but not proceeded with due to what was seen as excessive bureaucracy and too many fees.

Although there were medical checks for heavy vehicle drivers, the system was not water-tight, and some unfit drivers found ways of getting round the system. Incidents were a major concern. Compared to Singapore, emergency response plans were not well developed. When incidents did occur, the insurance and the police investigations needed to be better coordinated and more consistent in their approach.

The main problem for drivers was the difficulty in finding space to park at rest areas, as there were not enough rest areas and not enough parking spaces at the existing designated rest areas. When drivers stopped outside the recognised rest areas, they risked prosecution for parking illegally.

Overloading was noted to be a general problem for the industry, but it was seen as virtually encouraged by the enforcement system. If a truck was overloaded by up to 30%, the owner would be charged the equivalent they would have been charged had they applied for an over-weight permit; and a fine was imposed only when the truck was overloaded by over 30%.

Mr Lee made the point that the playing field needed to be levelled, as low-cost operators were undercutting others who used good equipment and maintained it well. Old, poorly maintained vehicles could offer cheaper rates, but at the expense of the community through greater delays due to under-powered trucks and breakdowns, and poorer air quality. Entry into the industry was too easy at present, as only small amounts of capital were needed to set up with old vehicles, and knowledge or experience was not required.

Some of the configurations allowed on the road were potentially unstable, combining a long vehicle length and high weight with relatively few axles. Unauthorised modification following the initial registration of the vehicle contributed to safety problems. A government-approved scheme for registered maintenance businesses that could certify roadworthiness, subject to audit, could improve the industry's efficiency, possibly even improving safety. Additionally, there was no control over the quality of spare parts used in maintenance; non-genuine parts were cheaper, but more likely to fail before replacement was due.

4.1.9 Linfox Malaysia

The discussion was conducted through a telephone conversation with Mr Goh, the Linfox Country Manager for Malaysia. There were two main areas of concern regarding truck safety in Malaysia: enforcement was not stringent enough, and there were too many old low-standard vehicles on the road.

Driver licences were not sufficiently enforced; many drivers had no proper licences, and many lacked a proper understanding of the purpose of a licence as a qualification showing driving competence, rather than just a piece of bureaucracy. There were no proper training schools, nor was there any process of re-assessing drivers after the initial test, and there was no age limit on driving. A related problem was that there was no grading of drivers according to ability; no special qualifications were required to drive hazardous goods.

There was no priority given to addressing overloading; consignors needed to take responsibility for the loads carried, and be held accountable where overloading was detected. The main offender seemed to be the construction sector rather than the logistics-chain sector. The effects of overloading were seen particularly in the poor condition of road shoulders and pavement edges.

Major crashes were seen as 'big news', but the actual consequences for drivers who had driven irresponsibly were fairly minimal, usually in the form of a fine. There were no manslaughter charges as is the case in other countries, and drivers were generally able to resume their driving careers. Inter-country movements were not seen as a major problem; the usual procedure would be for prime movers to exchange trailers at the border.

A shortage of drivers was an issue for the industry. Removing the worst vehicles in the fleet would free up some drivers who could move into more productive sectors. There was scope for the industry to improve its performance in many ways, such as fuel consumption and avoiding congestion.

The new occupational health and safety code was making a difference but many companies were still non-compliant. The government could do much to encourage adherence to the code through tax incentives, and the insurance industry could assist by reducing premiums in relation to the degree of compliance with the code.

Official thinking tended to be focused on fatalities; this gave the wrong picture. There were many injury-producing crashes involving heavy vehicles; besides which, the delay costs caused by crashes, slow vehicles and broken down vehicles were a drag on productivity. Government had been too accepting of safety problems relating to trucks and had not so far been serious about tackling them.

4.2 Visits in Thailand

Visits in Thailand included the following organisations:

- Transconsult, Bueng Kum
- TKL Logistics (Thailand) Co. Ltd
- Ministry of Transport, Chatuchak.

4.2.1 *Transconsult, Bueng Kum*

The purpose of this meeting was to obtain the perspective of experienced traffic safety engineers on truck safety issues in Thailand. The three participants all had many years' experience in traffic management and traffic engineering safety. Dr Cairney had worked with them on other projects in the past. Present were Mr Sukid, Principal of Transconsult Ltd, Mr Sanguan, Senior Engineer, Transconsult Ltd, and Mr Kittipol, an associate of the company with many years' experience as a senior officer in the Department of Highways. In their experience, the main safety problems associated with trucks were;

- Rear-end crashes with trucks parked or broken down by the side of the road, especially at night. This was especially a night-time visibility issue. Trucks were required to have retro-reflective markers, but these were usually in very poor condition. There was also a requirement that trucks should carry a rectangular warning sign to put out in advance of an immobile vehicle; however, this was rarely carried and the requirement was not enforced.

- Head-on crashes were also seen as an issue. More accurate terminology might be 'side-swipe from the opposing direction', as this occurred when trailers swung wide on curves, or because the truck engaged in other sudden manoeuvres. There were often problems with trailer couplings.
- Very often the brakes on semi-trailers and trailers did not function. Only the prime mover has brakes.
- Overloading is widespread, as enforcement of loads is in the hands of the Highways Department. In conjunction with poor practice in relation to the maintenance of braking systems, this was a serious safety concern.

Alongside these issues, there were a number of deficiencies in driver training which had safety consequences:

- Gear selection was a problem for a significant number of drivers, resulting in unduly slow climbs and descents and encouraging car drivers and motorcyclists into performing hazardous overtaking manoeuvres. Overtaking lanes had been provided at some locations, and these helped, but they were not frequent enough.
- Many drivers were unaware of the risk associated with wet pavements. Due largely to the road stone available, Thai roads tended to have generally low skid resistance and as a result were hazardous in wet conditions.
- Drivers of other vehicles often did not understand how to interact with trucks, especially the extensive blind spots of a truck, and the issues that this caused the driver.

Some road design features were noted to force difficult situations on drivers:

- U-turns were required in many circumstances, as it was difficult for drivers to judge traffic speed in high-speed situations, resulting in collisions.
- There was often insufficient space for drivers to make turns into other streets or entrances, resulting in trucks intruding into or blocking other lanes; this even applied at many signalised intersections.

Many of the major companies (particularly those transporting hazardous goods) had good safety management systems in place, and were using GPS-based technologies to manage speeds, driving hours and fuel economy.

There had been one major trial a few years ago for the hazardous goods sector. Approximately 50 trucks carrying hazardous waste had been fitted with GPS; the Office of Transportation Planning (OPT) had paid for the trial and the equipment. Industry participation on the trial was as far as the equipment was provided, but at the conclusion of the trial there was no further uptake as operators would have to install equipment at their own expense.

This emphasises the point that the level of safety is linked to what the industry is able to charge for its services. As the country grows, services will become more valuable and disruptions to service more costly, therefore increased investment in safety will become more attractive. It was considered that the heart of the issue is ensuring better control of driver behaviour, and this will be possible as more vehicles are equipped with GPS tracking devices.

4.2.2 TKL Logistics (Thailand) Co. Ltd

The meeting was held at TKL's depot with Mr Thongyu, Managing Director, Mr Chuchart, General Manager, Logistics and the General Manager, Operations. Mr Sanguan from Transconsult also

took part in the meeting, acting as an interpreter. Mr Thongyu is currently the Secretary of the Thailand Land Transport Association.

TKL Logistics (Thailand) offers a range of transport-related services, including freight forwarding, stevedoring, customs clearance and road transport. It has a container yard on the outskirts of Bangkok, and operates a fleet of approximately 50 articulated trucks and approximately 180 rigid trucks.

The viewpoint was expressed that drivers had no culture of following road regulations, and so could not be relied on without supervision or enforcement. The main issues were speeding, running red lights (this was noted to be particularly prevalent) and exceeding driving hours. Logbooks were required by law, but there was no enforcement. In 60-70% of crashes involving trucks, the truck driver was believed to be at fault. Approximately 50% of all crashes (not just truck crashes) were noted to involve alcohol. There was no reason to expect that truck crashes would be much different, as drinking on the job was understood to be widespread.

Larger companies had modern fleets which were well-maintained. However, the industry relied to a large extent on sub-contractors who ran older vehicles with component specifications which did not match current expectations or performance levels. Maintenance was also noted to be a problem for these vehicles; the practice of using spare parts from sources other than the manufacturer (either used parts or new parts from other sources) was noted as widespread. The performance of the non-original parts could not be guaranteed, either in terms of their safety performance or their service life. Further compounding the problem, substitution of parts was difficult to detect, and re-treaded tyres were a particular concern.

The road environment was believed to have contributed to 20–25% of crashes, as traffic safety was very badly affected by poor weather. Flat roads in low-lying areas in combination with heavy downpours created dangerous situations. Tyres on trailers and semitrailers were a particular problem as the best tyres were generally used on the truck.

The industry used two forms of monitoring for its drivers; tachograph systems which recorded hours of operation and speed on a card, and GPS monitoring systems. These were not compulsory, but the industry used them for its own management and purposes. The GPS systems were widely used where hazardous goods or high-value goods were being carried. GPS-based tracking systems had been successful in reducing speeds through the monitoring of drivers' records at periodic intervals.

It was noted that the industry was currently facing a skills shortage, as good, professional drivers were hard to find. The Land Transport Department undertook basic training; private training was available for companies that wished to upgrade their drivers' skills, with the vehicle manufacturers taking the lead in this and offering training (Toyota and Isuzu were mentioned as companies who had undertaken this).

The average for overloading was believed to be 38%; the Thailand Land Transport Federation was opposed to overloading, as it disadvantaged members who did the right thing. Law enforcement involved a number of challenges. At present, transport operators could rely on very little help from outside their organisation to ensure compliance. Police and Transport Department enforcement was at low levels, and unreliable. Many of the laws in place were out-dated, which contributed to the low value placed on compliance generally.

One very good result in relation to enforcement had been a campaign to encourage alcohol-free driving for public transport drivers during the major festivals of Songkram and the New Year. This had involved publicity and enforcement and had been highly successful.

Individual drivers and small operators were under strong financial pressure to maximise income, hence long driving hours, drug (amphetamine) use, speeding and overloading (although it should be noted that greed rather than necessity was the key factor in many cases). The low education of many drivers contributed to the low awareness of and concern about the risks associated with long driving hours and poor quality of rests between driving. It was noted that seat belt wearing was considered to be at an acceptable level, as enforcement was effective.

Eco-driving had not been taken up by the industry, but the fitting of aerodynamic devices to reduce air resistance was widespread, and the Ministry of Energy was active in promoting the use of alternative fuels such as compressed natural gas (CNG). Minimising fuel consumption was one of the objectives of the Department of Highways road improvement projects.

Infrastructure improvements directed specifically at truck safety included provision of rest areas; safety ramps in hill areas; guardrail, also in hill areas. Suggestions for improving the truck safety situation included:

- Raising the standard of truck driving. This needs to start with government policy, and it should involve the provision of training facilities (driving ranges), comprehensive training about wider issues than just driving (responsibilities to other road users, business issues, life-style) and be coupled to more consistent enforcement and better rewards for truck driving as a profession.
- Efforts to improve road standards, including improvements to the road surface (roughness), provision of shoulders where trucks can stop without obstructing traffic, provision of truck lanes on major roads and motorways, action to reduce unevenness at the joints between bridges and the road (caused by subsidence), and better and more consistent provision of direction signs.
- Action to improve maintenance standards, including reducing tax on spare parts, and providing certified garages that could bring a truck up to the required standard and certify it; at present, the only available system was to prepare the truck for the inspection, then submit it. If the truck failed, it had to be rectified then submitted again for inspection.
- A concerted campaign to deal with the overloading issues.

4.2.3 Linfox (Thailand) Co. Ltd

The meeting was with James Allman, the manager for Linfox Thailand. Linfox runs a fleet of just over 600 trucks in Thailand, including 200 Volvo prime movers. Its main business is transportation from warehouse to distribution outlets for a supermarket chain and other companies in the food and beverage industries, and for a major fuel company.

Bangkok is the hub for all operations; nevertheless trips to the far north or the far south and back can take 30 hours. For these trips, three drivers are employed – one driving, one in the cabin resting, and one in the bunk sleeping. Drivers are paid more than the required minimum, receive training, and are employed under conditions identical to those in other countries with regard to driving hours and work schedules. The company has no problem recruiting drivers as it is a preferred employer in view of its good wage rate, excellent working conditions and opportunities for further training and advancement. All training is done in-house. No driving range is available as yet. The Thailand industry has not matured to the stage where it is ready to collaborate on issues such as training – companies are still trying to establish their position in the market, and competition is fierce.

Growth in the transport sector is approximately 17% per annum. Some reliance is therefore placed on sub-contractors, who are difficult to control. All major crashes in which the company has been involved in the last three years have involved sub-contractors, not the company's own vehicles.

Due to the nature of the business, much of the travel is in the motorway system, which is generally very good – although the bridges can be problem. Many of the company's trucks are limited to 90 km/h, so that speeding is not an issue with these vehicles – however, speed limiting is not available on the smaller Japanese trucks.

Emissions standards are lagging, with current trucks required to comply with Euro 3 requirements. It will be many years before Euro 5 standards (current in Europe and Australia) are reached. Linfox is currently trialling LNG vehicles, where all installations are factory fitted. The fleet has panels fitted to the side under-run protection as an aid to aerodynamic efficiency; however, opinion on the overall benefits was divided as frequent minor collisions required repair.

One area where the company has taken the initiative is in educating the driver and the wider family about fatigue management and the life-style factors required to support a safe and successful driving career – adequate sleep, good quality rest and diet, and avoidance of stimulants such as high-caffeine drinks. A DVD for the whole family has been prepared and is given to employees. Eco-driving has not been undertaken in Thailand as yet, but course materials from the Linfox in-house course are currently being translated; the course is scheduled for introduction later this year.

Equipment failure was noted to be rare, and very rarely features in crashes. However, fatigue constantly shows up in minor property damage crashes. Two-up driving is of great help in managing fatigue in what can be extremely demanding driving environments. Labour costs are a relatively small part of the company's outlays, so this is affordable.

4.2.4 Ministry of Transport, Chatuchak

The meeting was held at the Ministry of Transport offices on Phaholyothin Road, Chatuchak District. The meeting was attended by: Mr Jakkrit Lautrerpeth, and Ms Orapun Jaturawit, Transport Technical Officer, Transport Affairs Division; Somwung Thongkhao, Chief, and Ms Watinee Sowampong, Transport Technical Officer, Accident Analysis and Protection, Ms Sinpoon Withayawongruchi, Chief, Road Safety Promotion Division, Mr Chukrit Tangchaitrong, Mechanical Engineer, Automotive Engineering Bureau and Mr Chatree Rajaratna, Transport Technical Officer.

There was no shortage of truck drivers; however, it was very difficult to get good drivers. Truck driving was seen as a low status job, filled by people with low aspirations and limited education. They therefore had limited awareness about safety issues. At present, truck drivers received 12 hours of training, covering traffic law, safe driving practice, first aid, alcohol and drugs, and management of their own health, followed by a practical on-road driving test. At present, this was delivered by two schools approved by the department. There was an opportunity for drivers to upgrade their skills by attending refresher courses, lasting 1–2 days, and provided free of charge. However, there had been a very small uptake. Much greater success had been achieved with special sessions to prepare bus drivers for the major holidays at Songkran and the New Year, which had been well-attended.

Major truck companies had high levels of training for their companies, which they managed internally. One of the large chemical companies which performed its own transport functions (Bayer) called on the Ministry for support with its program; speakers and materials (including leaflets and handbooks) were provided. The main problems were with smaller companies who did not put a high priority on safety. It was difficult to engage with these companies, since they had

little awareness of what the Ministry was able to offer. At present, the Ministry communicated information about training opportunities via an email contact list, advertising on the Ministry web site, and through radio announcements.

There were maintenance issues with the truck fleet. Trucks had to undergo an inspection annually and public transport vehicles every six months. The tests covered brake performance, the amount of 'freeplay' (the amount of steering input required by the driver to initiate a response in the vehicle) in the steering system and engine emissions. Many vehicles failed the test. There is a major problem with imported components for trucks. Non-genuine components often do not last long, possibly resulting in unsafe conditions. However, the main issue is the frequency and quality of maintenance.

The Ministry is in the process of introducing automated inspection stations for trucks. This provides fast, efficient, standardised assessment of vehicles, with objective, tamper-proof outcomes. Forty-five stations are in place at present, with another 15 to be commissioned by the end of the year, and a planned total of 77 stations. Over 100 items are checked at each inspection. There are still some introduction issues with the project, and it is too early for any assessment of the benefits. However, as the Ministry is committed to an evidence-based approach, it is expected that an evaluation study will be carried out.

4.3 Visits in Viet Nam

Visits in Viet Nam included the Ministry of Transport, Hanoi, and Linfox Vietnam.

4.3.1 Ministry of Transport, Hanoi

The meeting took place at the Ministry of Transport's offices in Tran Hung Dao Street, Hanoi. The meeting was hosted by Mr Nguyen Van Thach, Vice Director, International Cooperation Department; other attendees were; Mr Do Hun Duc, Vice Director General of Vietnam Register; Mrs Phan Thu Hien, Vice Director General, Directorate for Roads; Mr Haong The Tung, Senior Official, Traffic Safety Department; Mr Dang Tran Khanh, Motor Vehicle Inspection Department, and Ms Dang Thu Huong, International Cooperation Department. All attendees were from branches of the Ministry of Transport.

Dr Cairney began by introducing himself and ARRB, and briefing the attendees on the project and what it was hoped to achieve in the meeting. The Ministry team then provided details of the current situation and existing programs mapped out to address these issues.

Road safety was a major concern for the Ministry of Transport and the government generally, as road deaths amounted to approximately 11 000 per year. The government was in the process of introducing many measures, but outcomes had not been as good as hoped. Viet Nam is at the beginning of a Traffic Safety Strategy which will run through to 2020. It had been developed through a process of consultation with all relevant ministries. There was no specific mention of truck safety issues in the strategy.

At present, it was not possible to identify truck crashes or the deaths and injuries arising from them. A road safety database was currently being developed for the National Traffic Safety Committee, but was not ready yet. However, it was believed that casualties arising from truck crashes were fairly low in comparison to other types of crash, as motorcycles were the most pressing problem. It was believed that the main road safety issues applying to all vehicles were:

- alcohol and drug affected driving
- speeding (approximately 20% of crashes were estimated to be speed-related)

- Careless behaviour, which may be due to attitudinal problems and/or a lack of understanding of risk factors.

These three issues were general to all types of drivers and riders in the traffic system. Issues relating specifically to trucks were:

- Overloading, as this applied to the supply chain sector as well as the construction and primary produce sectors, and many consignors tended to overload their containers.
- Driving hours, as this was related to speeding and overloading as many drivers were under pressure to maximise the revenue from the truck.

Container trucks were seen as a major safety problem; they were involved in a very large number of crashes. As noted earlier, no specific figures are available. Note also that it was not possible to determine (without a detailed study) whether the high level of crash involvement reflects a high risk of a container truck being involved in a crash, or whether it reflects the large number of container - carrying trucks on the road.

Two programs were under way which were likely to have a major impact on truck safety – tracking devices and vehicle checking stations. Further detail is provided below.

Tracking devices

Tracking devices became mandatory on all vehicles carrying containers on 1 July 2011. This applies to vehicles with GVM of 7 tonnes or more. This followed a three-year lead time, during which operators were encouraged to fit the devices and gain experience with them prior to them becoming compulsory.

The fitting of an approved unit is a condition for operating a container-carrying vehicle. For regulatory purposes, the tracking device records speed and travel time. The operator must keep records of all data, which from now on will be inspected annually by the Ministry of Transport. In addition, highway police have printers which can be plugged into the system when the vehicle is stopped on the road. Presently, there are approximately 113 000 vehicles equipped with a tracking device. Permitted driving hours are a maximum of 10 hours in any one day, with a break required after 4 hours.

Vehicle checking stations

There is a program of installing vehicle checking stations on the expressways in progress at present, funded with help from the Japanese International Cooperation Agency (JICA). The stations will check both the vehicle dimensions and weight.

The issue of rest areas was also discussed. Regulations provided three levels of rest areas – service centres with the full range of facilities, rest areas with basic facilities, and informal rest areas. It was believed that rest areas were adequate and that sufficient rest areas were provided.

Other issues discussed included:

Driver licensing – it was well-established practice to require a higher grade of licence (category FC) for drivers driving container trucks, reflecting a higher degree of experience and competence than required for a normal truck licence (Category C). Category C licence holders had to have a car licence, be 21 years or over, to have a crash-free driving record and to pass a practical driving test. This permitted them to drive trucks greater than 3.5 tonnes. Category FC licence holders had to be at least 24 years old, to have had at least three years' experience on a Category C licence, to have at least 50 000 km crash free driving and to have passed a written and a practical driving test.

- Cross-border issues were not seen as a big problem as the usual arrangement was for loads to be transferred at the border to vehicles from within the country, especially when the neighbouring country drove on the other side of the road.
- Viet Nam was committed to the ASEAN roll-out of EC regulations by 2015. Three to four meetings were held every year amongst the transport ministries in the region to discuss progress towards the goal of having all 17 regulations in place by 2015.

4.3.2 Meeting with Linfox Vietnam

Dr Cairney met with Simon Hildebrand, Country Manager, Linfox Logistics, Vietnam at the Linfox office in Binh Than District, Ho Chi Minh City.

The transport business was experiencing growth strains, as the overall rate growth rate for the Vietnamese economy was about 10%; the 'advanced' consumer sector which Linfox serviced was growing at more like 15%. Current axle loads were satisfactory at 8 tonnes (though lower than in neighbouring countries).

At present, Linfox relied almost entirely on sub-contractors to deliver the actual transport services. However, things were reaching the stage where it would be cost-effective for Linfox to run its own vehicles. Linfox paid no additional premiums to its sub-contractor drivers (as it did for its own staff in Malaysia, for example); however, sub-contractors were obliged to offer the legally required rates and conditions. There was no shortage of drivers, but finding well-qualified drivers with a sense of responsibility was difficult. Advanced training was not generally available. This contrasted with Simon's previous experience in India, where a successful driver training program had been established in Tamil Nadu.

A considerable problem was that rules tended to be inflexible, and the government systems were not open to innovation so that it would not be possible to increase loads by introducing a new design of truck with an additional axle to spread the load.

At present, it was up to sub-contractors to establish and enforce their own driving standards, although Linfox encouraged them to follow good practice. Consideration had been given to bringing in some Linfox training staff from Thailand to 'train the trainers' and establish a program in Viet Nam. However, there had been little interest in the project.

One of the major challenges in Viet Nam was getting authority and industry interest in industry problems. The system was good at implementing solutions, but not at recognising problems or matching solutions to problems. Government agencies did communicate with one another to a certain degree; better than in some countries, but not as well as they did in others.

Infrastructure was a constant issue for Linfox. With its long length and narrow width, Viet Nam would be ideally suited to rail transport. However, the infrastructure was limited in what it could carry, and it was not particularly reliable. As an example, the rice crop had to be processed quickly and took priority at harvest time, clogging up the system for several days. At present, much of the south-north transport was by boat, which was relatively slow.

The highway infrastructure was generally not good, with only small amounts of dual carriageway. One of the consequences was that speeds were slow on the highway network (25 km/h average on the north-south trip, with an approximate length of 1800 km). On a trip of that length, Linfox would use a team of three drivers; however, this was not typical industry practice. The drivers need adequate rest times and need to understand both the risks they faced and their responsibilities to other road users. This applied to alcohol as well as fatigue. There was a real need to improve

fatigue management in the industry; as the average age of the workforce was 32 years, there was considered to be capacity to facilitate change.

The current system did not encourage the government to show leadership on this issue. It was really up to industry to take the initiative. Action needed to begin with the logistics side of the industry, which had the capacity to avoid overloading and to ensure reasonable time was available for the journey. Safety would show a major improvement if the current laws were enforced effectively.

4.4 Discussion

Over the course of the visits to Malaysia, Thailand and Viet Nam, and in reviewing the collected material, several key themes started to emerge. Predominantly, vehicle overloading, and the issues of old and poorly-maintained vehicles were recognised as the key safety issues in all three economies. This creates an unsafe situation, particularly when combined with deficient braking systems and inadequate maintenance.

In addition, overloading imposes excessive loads on pavements, causing damage and requiring that more be spent on rehabilitation and reconstruction in order to hold the road system together, resulting in less funds being available to the road system which would improve both efficiency and safety.

However, these two problems are not the major issues facing the transport market segment which is the focus of the present study, i.e. trucks in the logistic supply chain. The main issues facing this segment of the transport industry are:

- availability of well-qualified drivers, with a good understanding of their responsibilities and the risk factors associated with truck driving
- better management of fatigue, extending beyond driving hours to include life-style factors
- more extensive use of on-board tracking devices to monitor devices and speeds; coupled with this there was a need to teach companies how to make best use of the information the systems provided to improve their business performance.

Accordingly, the focus will be placed on addressing these issues in the compendium.

Although not mentioned specifically as an issue, a theme which ran through the discussions was the high degree of price competition in the road transport industry, particularly in relation to the overloading issue. Although the logistics supply chain sector can charge more for its services than the transport industry generally, this large pool of potential competition limits the extent to which this is possible.

In this context, persuading companies of the business case for investing in better safety performance is likely to prove productive. Programs to persuade the sector of the business case and practical schemes to encourage them to adopt better safety practice have therefore been given some consideration in the compendium.

5 LITERATURE REVIEW – STAGE 2

This section report documents the second stage of Task 1, the literature review. Building on the findings of the first stage of the literature review, and the findings from the questionnaire and visits to economies, issues discussed in this section include safety management practices, mitigation policies, technologies, safety awareness programs and industry-related issues.

The results of the visits to economies highlighted issues associated with the availability of well-qualified drivers, fatigue management, and the use of on-board tracking devices. As a result, these topics are the focus of this stage of the literature review. The structure of this section is as follows:

- Section 5.1 focuses on driver training programs, providing comment on the effectiveness of traditional training programs, and also workplace-based training programs.
- Section 5.2 focuses on eco-driving, providing a broad overview of the topic, and some research into its effectiveness.
- Section 5.3 focuses on fatigue, covering topics including the nature of fatigue and drowsiness, contributing factors, fatigue management and technologies.
- Section 5.4 discusses aspects of corporate safety management in the context of the above.
- Section 5.5 suggests some possible actions to improve safety in the supply chain sector in the longer term, and for applying the lessons to the wider trucking industry.

5.1 Driver Training

Driver training was mentioned as an issue by all the groups contacted during the consultation process. The importance of driver training has been identified as a key issue in road safety. It is particularly important for the drivers of heavy vehicles, as this task requires a specific set of skills and knowledge, separate and in many cases quite different to that required for the operation of passenger vehicles.

Most driver licensing schemes throughout the world includes a component of basic driver training; however, the curriculum and brevity of these schemes often attracts criticism. It is widely understood that the bulk of heavy vehicle operational knowledge is accumulated while ‘on-the-job’, in on-road scenarios and while drivers are undertaking freight transport tasks after becoming licensed, either under supervised or unsupervised conditions.

5.1.1 *Evidence of the Effectiveness of Training Programs*

Driver training programs are predominantly focused on one of two areas: developing driving skills such as speed control, braking and cornering, or modifying driver attitudes and behaviour. The latter are referred to as driver education programs rather than driver training, and have received an increasing amount of attention in recent years.

The general opinion of the industry and academia is that an increased level of driver training will have positive effects on road safety and reduce crash rates. However, there is serious doubt about how effective driver training is in reducing crashes. Some studies indicate a distinct lack of data which points towards a causal relationship between training and crash risk or crash involvement (TRB 2007). Training course content has largely been developed on an ad-hoc basis as a result of the collective opinion of operators, trainers and researchers, with a distinct lack of a professional instructional design approach (TRB 2007). A recent report on work-related road safety for the European Union Directorate-General Transport and Energy (Safety Net 2011) went further and concluded that there was no evidence in the form of properly designed scientific studies to show

that conventional fleet driver training is effective. Note that this does not necessarily mean that the training is ineffective – just that there are no robust studies to show that it is effective.

Another factor to be borne in mind is that training may be more effective in developing countries than it is in developed countries. In developed countries, familiarity with motor vehicles and the need to maintain them, understanding and acceptance of traffic rules, and awareness of the possible legal and financial implications of crashes may have reached higher levels than they have in developing countries. This greater understanding and awareness has been achieved through the hard-won experience of the two or three generations who have lived with motor vehicles as an integral part of their lives.

A study by the American Transport Research Institute (ATRI 2008) showed that the rate of incidents (reported crashes, lesser crashes and violations) for drivers in their first year of driving trucks was unrelated to the length of training they had completed or to the specific type of training they had undergone.

A large-scale study by the ATRI (2008) reviewed the crash involvement of drivers relative to the training programs they had received in an attempt to quantify the benefits of the delivery method and length of training. Training delivery methods utilised included classroom-based, field and 'in-truck', behind-the-wheel (with the student in control of the vehicle), and via a driving simulator. A statistical analysis found that there was no correlation between instructional environment and crash risk, indicating that students receive equal benefit from training, regardless of the delivery method. In contrast, Christie (2001) found that the best learning environment is on-road, and that greater levels of supervised on-road driving experience delivered while a driver is learning has the potential to reduce post-crash involvement by 35%, but note that this was based on novice car drivers. The ATRI study (2008) also found that the length of the training programs studied (between 88 and 272 hours) had little effect on driver safety performance, although this was noted to have the potential to be strongly influenced by the course curriculum; the authors suggested that length of training might be a more influential variable if the training was focused specifically on skill deficiencies.

Again, most research into the appropriate focus of driver training programs (aimed at addressing attitudes and behaviour, as opposed to development of driving skills) is based on studies of passenger car drivers, and is discussed here due to the lack of heavy-vehicle-specific studies. Haworth et al. (2008) concluded that most driver training programs focusing on the development of advanced skills such as skid recovery and manoeuvring in emergency situations yields few benefits for experienced car drivers, and in some cases could be counter-productive for young or novice car drivers. However, it should be noted that most advanced truck driver training programs focus on areas including safe following and stopping distances, hazard perception, low-risk driving and skid avoidance, all of which are expected to have a higher degree of on-road application than the course content which guided the Haworth et al (2008), conclusions. Hence, it is considered that training which focuses on developing skills in these areas is more beneficial.

Haworth et al (2008) provides comments on research conducted in Northern European countries that indicate that attitudinal and behaviour-based driver training which focusses on raising awareness of on-road crash risk factors (e.g. over-confidence), can lead to crash reductions. It is also noted that programs such as these (aimed at changing driver behaviour) are considered unlikely to have a dramatic impact if delivered in a single-day format, as this is not a sufficient length of time to facilitate behavioural changes, and the trainer often has little to no contact with the driver after the training has been conducted.

5.1.2 Effective workplace-based Training Programs

In contrast to the uncertain record of general driver training, defensive driver training delivered in the workplace has proved to be highly effective.

The best-known of these studies (Gregersen et al. 1996) was carried out in Televerket (the Swedish telecommunications company), which compared conventional driver training with group discussions, campaigns focusing on specific safety issues, and a group bonus for minimising crashes within the work group. Driving safety was monitored over a two-year period. The greatest crash reduction was experienced by the group which received driver training, followed closely by the group which received group discussion; this latter group had the lowest crash frequency and, by a large margin, the lowest crash costs of all the groups. The group receiving the bonus also experienced a reduction in crashes, but the group which was subject only to the campaigns showed no significant reduction in crashes.

Gregersen et al. concluded that driver training and group discussions are probably the two techniques best suited to achieve crash reductions in large organisations. However, the following points should be noted.

The study was not based on truck driving; the study does not describe the driving duties of the participants. Since the study was conducted with a telecommunications company, it is likely that the majority of vehicles that participants drove were cars or vans, with relatively few trucks. The driver training was conducted with cars. It may be that truck drivers would benefit more from training which involved manoeuvring of the vehicle, particularly if their skills in this area are not well-developed in the first place.

Gregersen et al. pointed out that the effectiveness of the driver training was in contrast to the earlier literature which suggests that driver training is ineffective in reducing crashes. Although the driver training in the study did involve skid recovery and manoeuvring practice, it also involved a commentary drive. The emphasis throughout was on creating insights into risks in traffic situations and understanding the driver's limitations rather than increasing handling skills. The driver was also given feedback about fuel consumption, so in this sense it was an early experiment in eco-driving. It is possible that a driving style which minimised fuel consumption also reduced crash risk.

5.2 Eco-driving

Eco-driving is a term used to describe the concept of a modified driving style which is aimed at achieving a reduction in fuel usage when compared to conventional driving styles. In this context, eco-driving encompasses a number of specific techniques which are each aimed at operating the vehicle's engine as efficiently as possible, thereby maximising fuel economy.

Although there was no strongly expressed demand for it during the discussions, eco driving has safety benefits as well as economic and environmental benefits. The discussion of the trip report (Section 4) concluded by making the point that in a strongly competitive business environment, operators felt they had to be cautious about investments in safety. Initiatives which could be shown to have commercial benefits as well as safety benefits were more likely to be attractive to operators in this environment. Consequently eco-driving, with its potential for a direct contribution to profitability through reduced fuel use and lower maintenance costs, may be attractive to operators.

The key aspects of eco-driving are:

- Smooth driving style – this refers to the avoidance of sudden or sharp acceleration or application of the vehicle's brakes, as this reduces wasted energy.

- Optimum gear-shifting – shifting gears only at the optimum operating speed range of the engine.
- Looking ahead – scanning the road ahead helps to achieve smooth driving, and allows possible hazards to be anticipated.
- Idle reduction – reducing the amount of time a vehicle is spent idling.
- Auxiliary systems – smart use of the vehicle's air conditioner.

Most research into the effectiveness of eco-driving has been conducted in North America and Canada, Australia, and the Europe. In Australia, some studies have been conducted by the Monash University Accident Research Centre (MUARC), with field-based trials conducted by transport companies themselves. This review focuses on MUARC publications and selected others from Australia, as they are considered to be the most relevant.

5.2.1 Economic and environmental benefits

While the bulk of the scientific research indicates that there are fuel economy benefits available via the implementation of eco-driving techniques and practices, there are degrees of difference in the claimed benefits, and there have been some criticisms of previous studies, mainly that field-based studies have not been conducted under 'real-world' conditions, and some assessments of the effectiveness of eco-drive training programs have not included a suitable control group (Symmons et al. 2009). Notwithstanding these findings, commenting on the specific claimed benefits of eco-driving techniques and associated training programs is beyond the scope of this research. However, a brief discussion of some of the claimed benefits follows.

It is claimed that the careful application of each of the eco-driving techniques alone can deliver fuel savings of anywhere between 1% and 25%, depending on the current driving style of the driver, and the vehicle's level of maintenance. As an example, driving with all tyres inflated to the correct pressure can deliver savings of up to 25% (State of Western Australia 2011); however, under-inflated tyres are requisite to achieving this level of benefit. Similarly, the application of a smooth driving style can potentially achieve fuel savings of between 2% and 20%. Based on the results collected during on-road, field-based trials conducted by transport companies in Australia, Linfox Pty Ltd showed that heavy vehicle drivers delivered fuel savings of up to 14%, and Blue Circle Southern Cement up to 27% in on-road scenarios after undergoing eco-driver training (EcoStation 2010).

5.2.2 Potential safety benefits

Although the economic and environmental benefits have clearly been demonstrated, it is much more difficult to establish the safety benefits in terms of crash reductions and this type of evaluation is not currently available. However, there are sound, evidence-based reasons for believing that eco-driving is likely to reduce crash risk and promote safety.

Eco-drivers often have lower maximum speeds, which can simultaneously reduce crash risk, and the severity of crash outcomes. Fewer gear changes may reduce fatigue, adopting a smooth driving style with respect to acceleration could potentially prevent some loss-of-control events and may reduce the risk of rear-end collisions arising from sudden braking. Other eco-driving techniques such as scanning the road ahead could lead to drivers being more alert, and therefore noticing hazardous situations sooner.

Training in eco-driving also imparts a thorough knowledge of the vehicle and its specifications and characteristics, such as the nature of the engine's horsepower and torque curves (in order to operate the engine in its optimum range), maintenance of correct tyre pressures and engine fluid

levels, and careful monitoring of the vehicle's payload. Attentiveness to certain areas such as tyre pressures and fluid levels may result in drivers noticing mechanical faults or defects more frequently, and attending to these before they lead to hazardous situations on the road.

Motor vehicles are often the biggest contributor to air pollution in major cities, and pollutants are known to have a significant impact on human health. Reductions in the time spent idling can limit the exposure of drivers and other personnel to the harmful effects of exhaust emissions, particularly at warehouses and delivery depots.

5.2.3 Evaluation of programs

A more in-depth understanding of the effectiveness of eco-driver training programs is provided by Symmons et al. (2009), who reported on a small field-based in-traffic trial where heavy vehicle drivers were instructed in eco-driving practices, key performance indicators such as fuel consumed, and the number of brake applications and gear changes were measured at six and twelve-week intervals, and compared to the same measures taken from a control group.

The results were positive and in some cases, substantial, and were also either present or progressively improving three months after the initial training. Importantly, there were no disadvantages in terms of slower average speed, or longer overall journey time for each of the trips undertaken by the drivers. A portion of drivers taking part in the training program had their key performance indicators (KPIs) measured immediately before and after the training course with the course trainer present, while a separate group of drivers only had their KPIs measured six weeks after completing the training. The results for the fuel consumption KPI for both groups is shown in figure 5.1

A particularly interesting finding was that drivers who did not have their KPIs measured immediately before and after the training course achieved fuel consumption figures similar to the control group. This strongly indicates that having a field-based aspect of the training is critical in terms of achieving successful outcomes.

A program recently implemented in the Australian States of Victoria and Tasmania by Fonterra, a leading multinational dairy company, introduced remuneration-based incentives for heavy vehicle drivers that achieve a reduction in fuel use by practicing eco-driving techniques (Miller 2011). Under the plan, drivers were offered either a 1% or 1.5% per annum salary pay rise if they used 5% less fuel. The results were encouraging, with between 4% and 6% reduction in the fuel usage within three months in most areas. There were, however, some reports of an increase in unsafe behaviour, including tailgating and lack of braking on downhill sections, indicating that careful management of driver behaviour is required in the implementation of such programs, particularly where a reward is offered.

Developments in in-vehicle technology and telematics in recent years have led to the introduction of a limited range of technologies aimed at both monitoring and reporting on driver performance, and providing assistance in terms of achieving the goals of eco-driving. At a very basic level, most modern vehicles are equipped with trip computers as standard equipment, most of which include average and instantaneous fuel consumption data. By monitoring the data, drivers can adjust their driving style (implementing the practices of eco-driving), and receive instant feedback in terms of fuel consumption data from their trip computers, thereby enabling the optimisation of vehicle operation for fuel consumption.

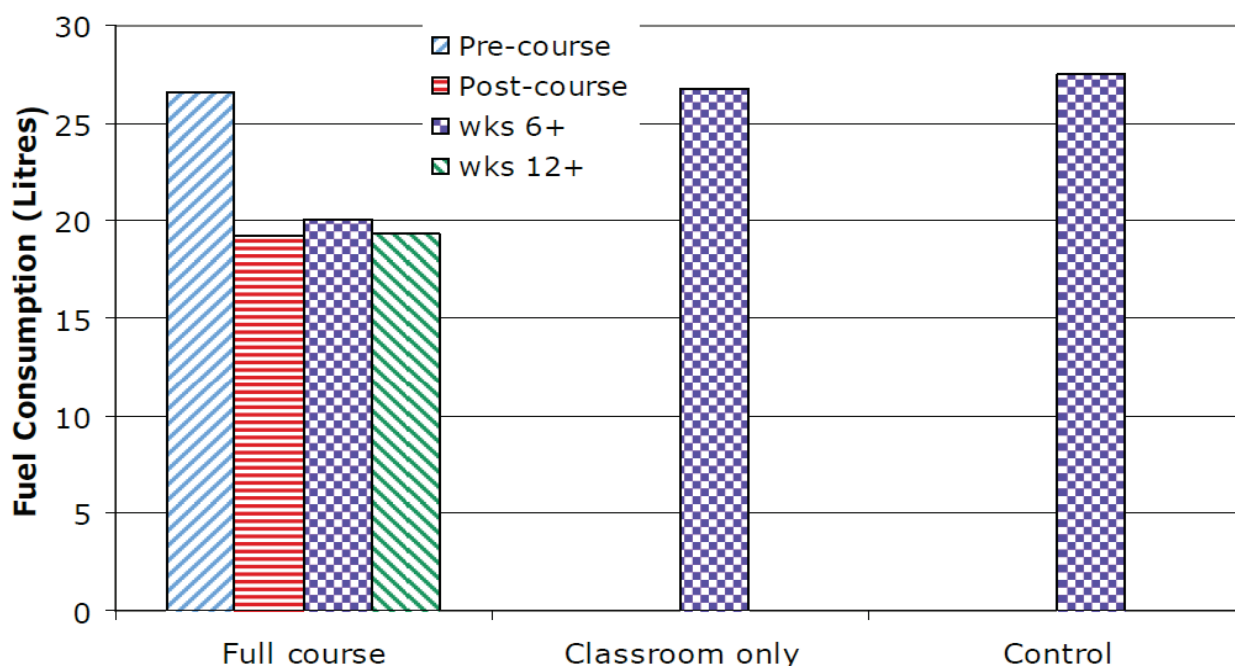


Figure 5.1: Results for fuel consumption KPI

There are few examples of after-market devices which provide this functionality. Garmin Ltd, a manufacturer of in-vehicle GPS navigation systems, currently offers a device which plugs into the vehicle's on-board diagnostic (OBD) plug, and transmits engine performance data via bluetooth to the in-vehicle navigation system, which the driver can then view. This technology is not available for heavy vehicles, due to differences in the OBD systems between heavy vehicles and passenger cars, and an internet search did not reveal that any of these technologies had been developed for heavy vehicles.

Some Australian fleet-management companies (ProconMRM Pacific, FleetEffect Pty Ltd, and Rankine Thompson Australia Pty Ltd) offer products based around vehicle tracking technologies that provide reports on driver behaviour including fuel use, sudden braking and over-speed events. In most cases this is achieved via a combination of GPS and mobile communications technology, combined with data from the vehicle's engine management system. This data is not available to the driver during the driving task, so it does not have the capability to directly influence driving behaviour (i.e. drivers only receive feedback on their driving style upon receiving the report).

An additional aspect of eco-driving which can be supported by in-vehicle technologies is the avoidance of traffic congestion. Most in-vehicle navigation units positioned within the high-end of the market have the capability to receive traffic reports, and offer the driver the option of re-routing the chosen route to avoid the congested area.

5.3 Fatigue and Drowsiness

Fatigue is acknowledged as a major problem for road transport operations. It is a complex issue, many aspects of which are not well understood. Nevertheless, some relatively simple remedies are available which, while not a complete answer to the fatigue problem, are likely to have a significant impact.

The UK Department for Transport recently commissioned a comprehensive review (Jackson et al. 2011), the main objective of which was "to provide a comprehensive and critical review of the literature that synthesises the evidence relating to fatigue and road safety" (p.18). The review followed a more rigorous method than is customary, in that three independent teams of researchers worked on the project, following an agreed method. Each team worked on a different set of research questions; their draft sections dealing with each of the questions were then circulated to the other teams for comment and feedback, and the project report was assembled once the final version of each of the sections had been agreed.

This section focuses mainly on that report, supplemented by recent Australian work as appropriate.

5.3.1 Nature of Fatigue and Drowsiness

Jackson et al. define fatigue as a gradual and cumulative process, associated with a loss of efficiency and a disinclination for any kind of effort. It increases with time spent on the task. This is distinguished from sleepiness or drowsiness, defined as difficulty in staying awake, determined by two independent mechanisms. These are the body clock or the pattern of alertness and sleepiness over the course of the day, and balance between how much sleep a person has had and the amount of time they have been awake. This distinction is important for understanding the nature of the problem. For example, drivers may be capable of driving safely for long hours if they are well-rested before commencing duty. On the other hand, they may very soon start to drive erratically if they have not had a good night's rest, or if they commence driving in the early afternoon when the body clock sets a low level of alertness.

Fatigue, sleepiness and drowsiness are generally used inconsistently and interchangeably in everyday speech and in much of the discussion in road safety. This is understandable, given that they often occur together and have similar debilitating effects on driving. The term fatigue will be used from here on to cover sleepiness and drowsiness as well as fatigue. Jackson et al. identify a substantial body of work which demonstrates how fatigue affects driving performance. They conclude it affects driving skills in three ways:

- it increases the frequency of errors (e.g. the number of times a driver intrudes on a neighbouring lane)
- it increases the size of errors (e.g. the distance that a driver intrudes on a neighbouring lane)
- it increases the variability of errors (e.g. reductions in the amount of time a driver drives in the centre of the lane).

5.3.2 Factors that Contribute to Fatigue

Crash rates are consistent with daily patterns of alertness. Although there is a large body of work showing that crash rates per unit of travel are highest in early morning hours, Jackson et al. cite only one paper that shows that the effects of sleep deprivation are exacerbated at these times – this is possibly because the relevant papers pre-date the 2000 cut-off for inclusion in that study.

There is mixed evidence regarding how the amount of time spent on the task affects fatigue, with some studies indicating an effect after a short period of 'driving' in a simulator, and other studies indicating that, with appropriate rest breaks, drivers are capable of driving safely on-road for relatively long periods. However, it is clear that drivers whose sleep has been restricted before commencing the driving task show much greater performance deterioration.

The risk of a truck driver being involved in a fatigue-related crash is related to a number of factors related to sleep patterns. The factors which were found to result in more than twice the probability

of being involved in a fatigue-related crash were taking medication with a drowsiness warning, working nights, less than 5.9 hours of sleep per night, and irregular work patterns.

Research suggests that drivers of commercial vehicles are exposed to fatigue as a result of long driving and work hours, shift work (particularly at night), and insufficient sleep before shifts. Self-reports of falling asleep behind the wheel – a very serious level of driving while fatigued – are associated with a number of driver characteristics: daytime sleepiness, long work hours with limited rest opportunity, older long-serving drivers, night-time drowsy driving, poor sleep while away on trips, and symptoms of a sleep disorder. A number of situational and organisational factors have also been found to contribute: time pressure stress, pay structures, lack of suitable rest areas, long waiting times to load or unload, insufficient driver numbers and poor roster planning. Several studies have reported that professional drivers do not obtain sufficient sleep.

5.3.3 *Fatigue Management in the Workplace*

There are a number of measures available to manage fatigue.

The most usual measure is to have a general limit on driving hours and limiting heavy vehicle drivers to driving the number of hours workers in other industries would normally work. This can cause problems for the transport industry as some trips cannot be conveniently completed in that time, and even though it might take only another hour or two to complete the journey, the truck cannot legally do so. This leads to widespread disregard of the driving limits.

Australia has a particularly challenging environment when it comes to managing driving time, due to the very long distances between the major centres, and has moved away from fixed driving hours as a method for ensuring that drivers obtain adequate rest. In 2008, a new set of procedures for managing driver hours was introduced with the aim of creating greater flexibility, while still ensuring that drivers were not fatigued (National Transport Commission 2008). Known as Basic Fatigue Management (BFM), the procedures allow drivers to work for up to 14 hours per day, provided the prescribed rest periods are taken. Trials of electronic work dairies are currently underway which will support these arrangements, and it is understood that arrangements which will allow even more flexibility while maintaining an acceptable work/rest balance are under consideration (Richard Hancock, Project Director, National Heavy Vehicle Regulator, presentation at Freight Week, Melbourne, 8 September 2011).

Analysis of investigations of truck crashes by the insurance industry shows that fatigue-related crashes have reduced from 20.3% of crashes in the 2007 edition of the report to 10.0% in the (Driscoll 2011) edition, although Driscoll does point out that this may be attributed to a range of factors in addition to the 2008 changes in driving hours management.

Napping i.e. taking short sleeps has proved to be an effective way of maintaining performance. Laboratory studies have demonstrated that when a driver takes a nap, alertness and driving performance improve; taking caffeine is also effective. Drinking coffee then taking a nap is also effective. Jackson et al. express reservations about the effectiveness of energy drinks (soft drinks containing caffeine) since they can be consumed at the wheel, so that the driver misses out on the benefits of the break from driving as well as the benefits of physical activity.

5.3.4 *Fatigue Management beyond the Workplace*

The transport managers interviewed in the course of the visits to Malaysia and Thailand indicated that driving hours were not a great concern for them, as most trips within the country could be comfortably accommodated within the current driving limits, perhaps requiring two-up driving in some cases. When cross-border traffic expanded, it was anticipated that this would involve only

the semi-trailers crossing the borders. Prime movers and drivers would deliver the semitrailers to the crossing point, and pick up an incoming semi-trailer for the return trip.

Of much greater concern was drivers' fitness for duty when reporting for work. Given the impact of inadequate sleep in driving performance, it is essential that drivers are well-rested and have had enough sleep when they report for work.

The home environment and life-style of many drivers may mean it is difficult to ensure adequate rest. Combinations of high temperatures for much of the year, crowded living conditions and different working hours for other members of the family may combine to make it difficult to obtain sufficient periods of uninterrupted rest. This may be exacerbated by other family members' lack of understanding of the vital importance of good rest for professional drivers.

The Linfox organisation in Thailand did mention that it had developed a DVD aimed at all generations of drivers' families to help them understand the importance of good quality rest for drivers, the possible consequences if the driver does not get this rest, and the steps they should take to assist the driver. The DVD appears to have been well-received; there has been no formal evaluation.

The NTC has also developed an educational video dealing with fatigue issues. This was developed as an element in the support package for its fatigue management program. It is targeted at drivers and emphasises the importance of adequate sleep and the avoidance of 'sleep debt' (i.e. the cumulative effects of insufficient sleep).

5.3.5 Technology for Fatigue Management

Many claims have been made about technologies which are able to detect the onset of fatigue in drivers. The most promising systems appear to be those which are based on the Johns' Drowsiness Scale (JDS), based on the analysis of eye movements, which indicates the early onset of drowsiness (Optalert 2011). The advantage of this method is that it detects the onset of fatigue early so that the driver can be alerted before performance is seriously degraded. Other systems which rely on other aspects of eye movement or head nodding do not detect the onset of fatigue until well past this point.

5.3.6 Infrastructure-based countermeasures

A recent Australian investigation investigated the possibility of infrastructure-based countermeasures for fatigue. A desk-top review identified potential treatments and the types of location where they were likely to produce most benefit. Consultation with road authorities identified the most promising types of treatment and possible locations where they might be trialled. One possible important insight to emerge from this process was that fatigue-related crash risk varies as a function of road geometry and roadside environment. If this is correct then these parameters should be taken into account when locating treatments.

The study identified six categories of treatments likely to be useful as fatigue countermeasures: rest areas, monotony reduction treatments (e.g. designing to have some curvature rather than long straight sections), perceptual treatments, signage and road markings, audible line marking treatments, safety barriers and clear zones. Some novel ways of combining specific treatments, that may be particularly effective as a fatigue countermeasure, are suggested.

These treatments potentially benefit all motorised road users. However, drivers of heavy vehicles in the logistic supply chain sector engaged in long-distance operations would be the main beneficiaries of a program to introduce such measures.

5.4 Corporate Safety Management

The measures discussed above address many of the most serious problems faced by the logistics supply chain sector of the road transport industry. The measures selected are, so far as the project team can judge, suitable for implementation in the target economies and likely to have an impact on crash occurrence.

However, they are far from a complete solution to the safety challenges faced by the sector. To raise the safety performance of organisations and to sustain this in the longer term will require that they embrace a safety culture and commit to a far-reaching range of measures to ensure that all worthwhile measures to improve safety are implemented. While this may be difficult in a competitive environment, there are a number of factors which will support this commitment. These include:

- the high value of a reliable service in the logistics supply chain industry, compared to other sectors of the transport industry
- the increasing value of vehicles and the goods they carry
- as countries grow, increasing prosperity raising the costs of crashes and resultant injuries, and associated compensation and insurance premiums.

On the basis of the limited contact the team has had with industry in the region, it is apparent that some organisations have already fully embraced a safety culture, or have values and attitudes which are conducive to its adoption. It was beyond the scope of this project to establish the extent to which these values and attitudes were established in the logistics supply chain sector. Investigating this issue could be a useful starting point for encouraging greater commitment to safe operations.

5.4.1 Value of Demonstration Projects

It is difficult to persuade people of the importance and practicality of measures to improve safety by reference to abstract ideas and statistics. This is made even more difficult where changes in procedures and financial outlays are involved.

In contrast, practical examples can often be persuasive. People can see the benefits of the safety programs, and perhaps be persuaded that the changes involved or the investment required are manageable, and represent good value for money. Success with implementing one safety measure can foster awareness of other safety issues and the realisation that they too can be managed. The hope is that experience with a number of successful measures will lead to a demand for comprehensive safety management within the company. The tools to realise this are discussed in the following section.

The role of government up to this point is to support, encourage and provide some of the funding. Once enough companies have embraced this approach and there is general acceptance of its value in the logistics supply chain sector, there is scope for government to act to strongly encourage the remainder of the sector to adopt these practices. This may take the form of providing advantages to companies that comply with best practice, or of disadvantaging or compelling firms that have not yet fully complied.

In the very long term, it may be possible to extend these good practice requirements over a progressively wider range of the road transport industry, eventually embracing the whole industry.

5.4.2 Application of Corporate Safety Management Programs

To assist the (Australian) National Transport Commission develop a strategy to encourage the corporate sector to become more engaged in road safety, Mooren et al. (2011) conducted a review of existing corporate safety programs focusing on road transport. Although they concluded that there was 'surprisingly little evidence about the effectiveness of corporate safety programs (page 7), they also concluded from a detailed examination of a small number of studies that safety management characteristics may be associated with good safety outcomes.

The Mooren et al. review is mainly focused on programs based on standards and auditable safety management programs which, compared to other types of program, are expensive and may not appear to give good value. Other types of program mentioned in the review are:

- benchmarking programs, which encourage commitment and learning from peers, but are limited by the reluctance to share sensitive information
- continuous learning programs, which provide a good opportunity for information exchange between organisations, but which tend to be ad hoc in nature and have had little uptake
- codes of practice programs provide good advice, but there is no mechanism to ensure the advice is acted on effectively.

In Australia, The NHVAS offers transport operators exemptions from normal mass and driving hours requirements in return for achieving accreditation (National Transport Commission 2011). Compliance requirements relate to maintenance management, mass management and driving hours management. The exemptions take the form of being permitted to take trips with over-dimensional or overweight loads without having to apply for the permit which would normally be required, the company being trusted to abide by the conditions which would normally apply in such cases. Records are audited to ensure compliance with conditions. Accreditation also allows companies some additional flexibility to accommodate long trips through a complex arrangement to allow longer working times to be compensated for by longer rest periods within a set time frame. As is the case with the Oregon Trusted Carrier scheme, the operator receives a commercial advantage in return for demonstrating high levels of compliance with safety and other requirements. Road authorities benefit by a reduced administrative workload in approving trips for companies with a good understanding of permit conditions and a demonstrated record of compliance.

Running in parallel with the NHVAS is the industry-sponsored Trucksafe program which focuses on improved safety management (Australian Trucking Association n.d). The scheme is run by the Australian Trucking Association (ATA), the peak body for transport operators. The ATA conducts research and provides advice and services such as TruckSafe to the industry, as well as representing industry views to government. Operators commit to following agreed procedures in relation to four safety-related areas – management, maintenance, work-place and driver health and safety, and training. Compliance with the standards is assessed through a program of regular and randomly-timed audits. The scheme does not provide any direct benefits in terms of avoiding government inspections; its advantage is that it provides customers with a guarantee of a safe and reliable carrier service, and enables operators to promote their safety image through a letter and a certificate of accreditation, and through logos on the vehicle and company stationery.

The Oregon Trusted Carrier Partners is not mentioned by Mooren et al., but this scheme has many similarities to the NHVAS, in that it provides some practical advantages to carriers who join the scheme in return for high levels of compliance and other regulatory requirements (Oregon Department of Transportation 2011). Carriers qualify as a Trusted Carrier by enrolling in the program, equipping their trucks with transponders which enable them to avoid stopping at weigh

stations, and passing a review of their compliance with registration, tax, and safety requirements. In terms of the safety requirements, they must not be judged unsatisfactory during the review of their records, they cannot be the reviewer of safety records, they cannot be participating in the State's safety improvement program, driver and vehicle out-of-service percentage must be at or below the national average and the company must not have any serious safety violations on record, including offences such as driving under the influence. All the company's vehicles are provided with a distinctive Trusted Carrier licence plate.

The transponder enables pre-clearance for the vehicle as it passes over weight sensors at highway speed – without the transponder, the vehicle would be required to stop at weigh stations for a more accurate determination of its weight. The distinctive plate exempts participating vehicles from random safety inspection and safety compliance reviews, unless the appearance of the vehicle or the behaviour of the driver warrants it. The Trusted Carrier scheme confers commercial advantages on the participating companies and assists the Oregon Department of Transportation to focus enforcement resources where they are most needed.

Inspection of the website shows several hundred companies participating, with many from neighbouring states in addition to Oregon companies.

The European Charter for Road Safety also deserves a mention in this context. In operation since 2005, over 1700 organisations were participating by 2010. These organisations included companies of all sizes, professional associations, non-government organisations, institutions and regions and cities. By signing up to the charter, signatories make commitments to follow the five pillars taken from the action plan on the Decade of Action for Road Safety, i.e. to improve road user behaviour, the safety of the vehicle, the safety of the infrastructure, professional transport, and to make better use of crash data. However, the weak point of the program is that there is no independent audit of performance; organisations are encouraged to monitor their own performance.

5.5 Long-term Improvements of Safety in the Sector

There are a number of schemes to assist and encourage companies in the road transport sector adopt best practice in relation to safety and other areas.

These schemes tend to be evidence-based in that the individual requirements of the schemes either have a demonstrable relation to safety (e.g. trip scheduling, driver qualification or maintenance standards), or are indicative of a well-functioning organisation (e.g. no outstanding taxes or charges). However, there are as yet no direct evaluations that demonstrate that the schemes have in themselves resulted in improved safety.

Probably the most comprehensive guidance to date is available on the Australian National Transport Commission website (<http://www.ntc.gov.au/corporatesafety/>).

6 COMPENDIUM OF ROAD SAFETY INTERVENTIONS

This section documents Task 4, the compendium of safety interventions. The criteria for inclusion in the compendium are detailed, along with the measures and safety interventions themselves. Some further actions which would help advance truck safety in the target economies are also provided.

6.1 Criteria for Inclusion

The safety interventions included in the compendium have been selected on the basis of the information collected during the visits to the three member economies and discovered during the course of the literature review.

6.1.1 *The Need for the Proposed Interventions*

Based on the findings of the visits to the economies, there is a demonstrated need for all the interventions included in the compendium. Although these needs do not apply equally to all companies or to all sub-groups in the logistics supply chain, the needs are broadly based.

6.1.2 *Measures which are appropriate for the industry and the administrative and enforcement capacities*

There are many examples of road or transport technology programs which have failed completely because trained personnel have not been available to operate sophisticated equipment or systems requiring complex data handling.

Measures have therefore been chosen which, so far as ARRB can judge, appear to be appropriate for the level of management capacity in transport companies in the logistics supply chain. Care has also been taken to ensure that measures do not rely on unrealistic assessments of the data systems in the government structures, or on overly-optimistic assessments of the relevant government body to provide administrative or enforcement support for the measures.

6.1.3 *Measures which are evidence-based*

It was an aspiration of this project that all programs recommended for the compendium should be firmly evidence-based. Unfortunately, there are few interventions in the truck safety area which can claim to be soundly evidenced-based in the sense of safety interventions with specific goals which have been subject to rigorous evaluation. Given the size of the problem and the importance of the road transport industry, this is somewhat surprising. Therefore, very few of these evaluations are based on experience in developing countries.

The measures put forward are, however, evidence-based to the extent that this is possible. In some cases, even if the complete programs have not been comprehensively evaluated as yet, some or all of the elements in the program are based on empirical findings or practical experience.

6.1.4 *Measures which are immediately applicable*

Only one of the suggested measures would require legislative changes of a minor kind. Others might benefit if accompanied by legislative change, but this would not be necessary. Many of the proposals could be implemented at low cost and in a relatively short time frame by tailoring material available to suit local conditions. Although this should not be difficult, it must be stressed that careful adaptation carried out in association with rigorous pilot testing is likely to be essential to ensure success.

6.2 Safety Measures and Interventions

The proposed safety measures and interventions, and their goals are as follows:

- Driver training – for the purposes of facilitating behavioural change amongst drivers.
- Eco-driving – for promoting safe driving practices.
- Fatigue management – to help reduce the number of fatigue-related incidents.
- Corporate safety programs – to foster an attitude focusing on safety within organisations.

Although there was little mention of eco-driving in the discussions with stakeholders in APEC economies, and no strongly expressed demand for it, training in eco-driving techniques has demonstrated safety benefits as well as economic and environmental benefits. The report of the visit (Section 4) concluded by making the point that in a strongly competitive business environment, operators felt they had to be cautious about investments in safety. Initiatives which could be shown to have commercial benefits as well as safety benefits were much more likely to be attractive to operators in this environment.

Consequently eco-driving, with its potential for a direct contribution to profitability through reduced fuel use and lower maintenance costs, is recommended in the compendium as an effective safety measure, and is expected to have a high probability of uptake.

The following sections provide further detail on each of these safety measures.

6.2.1 Driver Training

Driver training emerged as a key need in each of the economies visited. Two distinct and separate measures are proposed in this instance:

- driver training centre of excellence
- in-service safety training.

The first measure requires substantial investment and long-term commitment, and is aimed at new drivers entering the logistics supply chain sector. The second requires a lower level of investment and is aimed at continuous improvement of the existing workforce. Further information is provided below.

Driver training centre of excellence

The logistics supply chain sector of the industry has higher expectations of its drivers than most of the rest of the transport industry. Reliability and safety are of fundamental importance in this sector of the industry. Well-trained drivers are therefore sought as a priority. At present there appears to be little opportunity for training beyond the basic licence which is required of all truck drivers.

One way of meeting this need would be the establishment of a heavy vehicle driver training school in each economy. Due to differences in language, it is considered unlikely that there would be advantages in the approach of economies setting up joint training institutes in partnership with neighbouring economies. However, collaboration between the institutes in terms of sharing knowledge, curricula and training techniques and methods developed would be very valuable.

The overall success of the institutes will depend largely on two key factors:

- Adapting recognised best practice to create a curriculum which meets the specific needs of the economy's transport sector, drawing on the skills of local and overseas experts in driver training.

- Developing a sustainable business model for the institutes. Although there is a need for trained drivers, some companies are reluctant to pay for driver training, due to the highly competitive nature of the business environment. Financial support is likely to be necessary to launch the institutes; ongoing support may be necessary until the value of the driver training achieves wide industry recognition and the logistic supply chain sector expands to a level where the institutes can be supported by the industry.

In-service safety training

The second proposal is to make available to industry a driver training package based on the work of Gregersen et al (1996). This study compared four methods to improve driver training and found that while incentives and locally based campaigns were not effective, substantial crash reductions were achieved by two treatments, a form of driver training which concentrated on developing insights and recognising limitations, and group discussions of safety issues.

It is proposed that the group discussion be offered to companies. The framework for the sessions should be developed by a team of expert drivers and other road safety professionals, supported by an expert in the conduct of group discussions drawn from academia or the market research industry. The team should identify the issues faced by drivers in the logistics supply chain sector, construct a conversation about these issues which brings out all the relevant factors relating to safe operation and good practice, then reduce this to a series of statements, questions and prompts which would be suitable for a group discussion session. Facilitators should then be trained in conducting the group discussions.

Following the Gregersen model, the group discussions should be held at intervals over a period of several months. Depending on their success and reception, it may be appropriate to take on some of their functions as part of regular workplace meetings.

Given the success of the work on which this was based; it seems likely that this program would be effective in reducing crashes and injuries. What is less certain, however, is the support it would receive from transport companies, who may be reluctant to pay drivers to attend training in view of the commercial pressures in the sector. High levels of financial support may be necessary to help establish the program until its effectiveness and impact on profitability are established in the local context.

Best practice for safety training programs

Based on the results of the literature review into driving training, the following key points are summarised here and are considered to be indicative of the world's best practice in terms of driver training and education:

- A targeted program. Haworth et al (2008) highlighted the importance of first conducting an analysis of the education and training needs of the organisation, in order to increase the relevance and value of the training program. This is considered critical in the success of driver training programs delivering road safety benefits.
- The right students. While researchers such as Christie (2001), identified that the largest benefits in training programs are likely to come from training novice drivers, it is considered that all drivers, regardless of age and experience should undergo driver training, as this further strengthens an institutional approach to safety.
- Systematic training design shown in Brock et al. (2007) highlighted the lack of understanding and adoption of recent research into learning styles, cognitive strategies and past training experience within the current range of driver training programs. This knowledge should be used to further develop driver training programs.

- Course scope. Haworth et al (2008) concluded that courses aimed at teaching advanced driving skills were likely to yield less safety benefits than those aimed at modifying driver attitudes and behaviour. It is recommended that driver training courses provide a strong focus on this aspect.
- Course length. While studies such as that conducted by the ATRI (2008) found little difference in safety benefit between short and long courses, it is recommended that courses aimed at addressing driver attitude should be longer than those aimed at teaching skills, due to the expected longer timeframe required to adopt behavioural changes. In order to ensure retention of learning, it is recommended that follow-ups or refreshers are conducted.
- Delivery method. Based on Christie (2001), it is expected that the highest benefit will come from training delivered in an on-road scenario, with the student operating the vehicle. While this is recommended to be the focus of such training courses, it is considered good practice that a range of delivery methods be included, to cater for the learning styles of different individuals.
- Suitability of trainers. Research conducted by the TRB (2007) noted that while trainers were often highly-experienced drivers and industry professionals, there was often a lack of a formal procedure to measure and ensure their effectiveness as a trainer and teacher.

In terms of case studies, Ashok Leyland (India) is considered to be representative of a highly successful driver training provider in the APEC region. Of particular commendation is the wide scope of training courses that are offered, ranging from beginner and experienced (refresher) training, to specific hazardous-goods courses, and the focus on good driver health, wellbeing and lifestyle. The length of the training courses is also extensive, with courses ranging from several days to between two and three months. Ashok Leyland have trained many thousands of drivers over a 12-year period.

6.2.2 Eco-driving

Eco-driving, while not focused on or mentioned in particular as part of the questionnaires or visits, should be strongly considered for implementation due to the combination of fuel usage reduction and safety benefits that it offers.

Despite the current level of implementation of eco-driving practices within the industry in developed countries, there exist relatively few in-depth guides on how to properly implement eco-driving practices and techniques, possibly because the majority of this material has been developed in-house by training providers and is considered to be proprietary information.

One of the few available in-depth resources has been produced by a group led by the West Australian State Government, and comprising various industry members, and consists of an in-depth guide aimed at encouraging and assisting transport companies to reduce their CO₂ emissions. The guide, titled CleanRun EcoDrive (State of Western Australia 2011), outlines the broad and specific benefits of eco-driving, provides a resource kit (material in paper format and on CD-ROMs), and outlines a timeline and action plan for the successful implementation of an eco-drive program.

The International Road Transport Union (IRU 2009) has produced a free two-page instruction guide on the principles of eco-driving, covering topics including trip planning, vehicle maintenance, tyre pressure maintenance, smooth driving and idle reduction, providing some details on each topic area.

In recent years, some heavy vehicle driver training providers have begun to offer eco-driving training courses as part of their standard curriculum, with some even including aspects of

eco-driving as part of their defensive or advanced driver training programs, in recognition of the link between the two. Most courses include components of classroom and field-based instructions. As an example, EcoDriver, a program operated by Strategix Training Group in Queensland, Australia, covers the following topics:

- what is a smart driver?
- vehicle maintenance
- six-point system of vehicle control
- progressive shifting
- smooth vehicle operation
- progressive braking
- auxiliary braking systems
- scanning the road ahead
- excessive idling
- greenhouse effects
- putting it all together.

These topic areas were the basis of the eco-driving training program conducted by a transport company in Australia, as reported by Symmons et al (2009), which was rolled-out for a selection of the drivers involved in their cement/concrete distribution network.

Developments in in-vehicle technology and telematics in recent years have led to the introduction of a limited range of technologies aimed at both monitoring and reporting on driver performance, and providing assistance in terms of achieving the goals of eco-driving. At a very basic level, most modern vehicles are equipped with trip computers as standard equipment, most of which include average and instantaneous fuel consumption data. By monitoring the data, drivers can adjust their driving style (implementing the practices of eco-driving), and receive instant feedback on fuel consumption data from their trip computers, thereby enabling the optimisation of vehicle operation for fuel consumption.

There are few examples of after-market devices which provide this functionality. Garmin Ltd, a manufacturer of in-vehicle GPS navigation systems, currently offers a device which plugs into the vehicle's on-board diagnostic (OBD) plug, and transmits engine performance data via bluetooth to the in-vehicle navigation system, which the driver can then view (<http://gbr.garmin.com/ecoroute-hd/index.html>). This technology is not available for heavy vehicles, due to differences in the OBD systems between heavy vehicles and passenger cars, and an internet search did not reveal any of these technologies that had been developed for heavy vehicles.

Some Australian fleet-management companies (ProconMRM Pacific, FleetEffect Pty Ltd, and Rankine Thompson Australia Pty Ltd) offer products based around vehicle tracking technologies that provide reports on driver behaviour including fuel use, sudden braking and over-speed events. In most cases this is achieved via a combination of GPS and mobile communications technology, combined with data from the vehicle's engine management system. Examples of the systems offered by each company are provided below:

- Procon MRM Pacific – http://www.proconmrm.com.au/content_common/pg-reports.seo.
- FleetEffect Pty Ltd – http://www.fleeteffect.com/solution_details.php?pid=7.
- Rankine Thompson Australia Pty Ltd – <http://www.fleetseek.com.au/fleetseek-benefits.php>.

The reported data is not available to drivers while they are completing the driving task, so it does not have the capability to directly influence driving behaviour (i.e. drivers only receive feedback on their driving style upon receiving the report). Hence, it is not expected to be able to yield the same level of benefits as in-vehicle data provided on a real-time basis.

An additional aspect of eco-driving which can be supported by in-vehicle technologies is the avoidance of traffic congestion. Most in-vehicle navigation units positioned within the high-end of the market have the capability to utilise traffic data, and offer the driver the option of re-routing the chosen route to avoid the congested area. As an example, the 'Navman' series of in-vehicle GPS navigation systems offered by MiTAC Intl. (<http://www.navman.com.au/car-GPS-devices/features/>), provide two different methods of dealing with congestion:

- Smart Route, which uses historical traffic information provided by a third-party to predict and guide the user to least-congested roads, based on the time of travel during the day
- Live Traffic, which provides real-time information on congestion and crashes.

6.2.3 Fatigue Management

The literature review, and some responses obtained during the visits, covered material which showed that as well as hours spent working, lifestyle factors are an important determinant of how fatigued the driver is. In particular, inadequate sleep is an important contributor to feelings of drowsiness, and this is particularly the case where the sleep deficit is cumulative.

Getting enough sleep to perform the driving task safely depends on conditions in the home, and on the behaviour of other people with whom the driver shares it. The Linfox organisation in Thailand has developed an innovative approach to improving the quality of rest at home by producing a DVD and distributing it to its drivers. The DVD is targeted at the family of the driver as well as the drivers themselves, so that they all understand the critical importance of good sleep for the safe performance of the driving task. The DVD also explains what is required to ensure good sleeping patterns, and suggests ways in which various family members can contribute to this.

The Linfox DVD has been well-received by the workforce, but no formal evaluation has been carried out. It is proposed that a similar DVD be prepared for each of the economies. If the Linfox organisation is willing to make their DVD available, this would represent the best possible starting point.

The first step would be to review the material on the Linfox DVD and any other relevant material. A generic script should be developed following the review, translated into the language of each of the three economies. Where appropriate, the script should be tailored to conform to local customs and beliefs, and to reflect local attitudes and values.

Each version should then be filmed and edited in each of the economies to ensure the local reference remains strong, as this will strengthen the overall impact. The DVD should be fully evaluated in each economy, based primarily on self-reports of sleep behaviour and feelings of drowsiness or alertness during the day.

6.2.4 Corporate Safety Programs

Three separate measures are proposed under the generic title of 'corporate safety programs', the first being a series of safety workshops, an industry-sponsored truck safety accreditation program, and a government-sponsored 'trusted carrier' program. Further information is provided below.

'Safety as good business' workshops

It is proposed that a workshop should be developed and held in each of the three target economies on the theme of 'Safety in the road transport industry as good business practice'. The workshop would be aimed at business owners and senior management in the logistics supply chain sector (but open to other sectors of the road transport industry).

The workshop would make the business case for good safety practice with a view to encouraging businesses to invest more in safety. The workshop would be delivered in the language of the economy and would draw heavily on local input. One or two speakers from other economies could be involved to give added depth and interest. Features of the workshop would be:

- an exploration of the costs of crashes, including the full range of costs to the enterprise
- benefits of scheduled maintenance (input from vehicle and tyre sectors)
- principal causes of truck crashes and ways to avoid them
- eco-driving
- fatigue management
- case studies.

Training courses may be available on which the workshop could be modelled. The best way to develop the workshop will be to engage trainers who give similar courses in developed countries to engage with a group of local experts to develop the curriculum and the materials. Once the materials have been developed, it will be necessary to train a small number of facilitators in the delivery of the course in each economy.

In view of the way the whole community is likely to benefit from the program in terms of improved road safety and the improved efficiency of the transport sector, it would be appropriate for governments to contribute to the costs of these programs.

Industry-sponsored Safe Truck program

An industry-sponsored program to accredit operators would be a relatively easy way to encourage operators to invest more in safety. An industry-operated scheme would have the advantage that it would not require legislation and so could be introduced relatively quickly. However, the only advantage industry accreditation would be likely to confer would be customer recognition of the quality and reliability of the service provided, rather than exemptions from government checks and inspections.

The TruckSafe program run by the Australian Trucking Association is considered to be an appropriate model to use as a starting point for the development of a local model.

Rigorous auditing of the program will be necessary to ensure the integrity of the program, coupled with high levels of certainty that breaches in the conditions will result in the speedy imposition of sanctions, culminating in expulsion from the program.

Government-sponsored Trusted Carrier program

A government-sponsored program would take the concept outlined above one step further. Subject to a rigorous audit program supported by random checks, operators who signed up for the program could be granted exemptions from routine road authority checks. For example, an operator who has a contract with a recognised service provider to service the fleet's vehicles would be exempt from routine government inspections; operators with a consistently good record of compliance with mass limits and documentation of load mass might be granted exemptions from weight checks, apart from random compliance inspections. Other conditions could be required of the operator as part of the compliance package, such as strict compliance with driving hour limits or a fatigue management program, or compliance with speed limits as demonstrated from GPS-based vehicle tracking systems. A distinctive number plate would assist authorities in the management of the program.

Depending on the nature of existing legislation in the different jurisdictions, an initiative such as this may be possible by changes to operating procedures and regulations, or it may require legislative changes. As would be the case with an industry-based program, random checks and rigorous auditing of the program, coupled with high levels of certainty that breaches would be detected and that sanctions would follow would be essential to ensure its integrity.

6.3 Further Actions to Support the Advancement of Truck Safety

In addition to the four strategies presented above, the possibility exists for the implementation of further actions to support the advancement of truck safety in the region. These further actions focus more on addressing over-arching issues within the industry, as opposed to single, distinct concerns.

6.3.1 Development of a Logistics Supply Chain Safety Strategy

Increasing economic activity in the three economies studied – Malaysia, Thailand and Viet Nam – is likely to facilitate substantial changes in the amount of truck travel. Given the involvement of all three of these economies in manufacturing and international trade, combined with a shift towards more western-style consumption patterns with large retail chains capturing more of the market share, the logistics supply chain sector is likely to grow very rapidly. APEC economies should consider developing long-term strategies to address potential future safety issues in this sector.

Since such long-term strategies apply only to one distinct sector of the road transport industry (supply chain), legislation and regulatory change is not considered an appropriate basis for the strategy, other than legislative changes which allow developments directly geared to the needs of the supply chain sector. Legislation which imposes requirements on the whole road transport industry is not appropriate in this context, even though there may be a strong case for certain changes when the truck safety problem is considered as a whole.

In each of the studied economies, government agencies, organisations representing operators in the logistics supply chain business, and some of these businesses themselves need to collaborate to create a strategy for improving safety in the sector. The strategy would specify the actions to be taken, the links and connections between the actions, and a broad time frame. An action plan should then be developed which specifies responsibilities for stakeholder groups, timelines, and arrangements for monitoring and evaluation. In the short term, a good starting point would be the actions specified above in the compendium of safety interventions.

Under such a concept, the principal role for government would be to:

- encourage and support the logistics supply chain sector in its efforts to improve safety via financial contributions
- promote campaigns to increase awareness of safety issues
- make the business case for greater investment in safety
- develop schemes to reward operators who actively engage in safety management and are prepared to have their efforts monitored and audited.

Governments would also have a role in providing financial support for on-the-job safety training, eco-driving and fatigue management (as described in previous sections). In terms of a heavy vehicle driver training centre, governments should consider either setting up a government centre to undertake this task, or simply providing practical and financial support to a centre set up and operated by the private sector on a commercial basis.

While it may be too ambitious to think in terms of a regional strategy, it would be advantageous for economies to stay informed of each other's strategies, and to ensure consistency where possible. In the longer term, a strategy to increase the range of actions to improve safety in the logistics supply chain sector can be considered. Possible actions could include:

- a recruitment plan for the sector to address the driver shortage
- enhanced accreditation schemes (industry-based and/or government sponsored); the basic position would be that operators who undertake additional steps to improve safety would receive additional recognition for safety and reliability and/or tangible advantages with respect to weight checks or mechanical inspections
- advice regarding costs and benefits of ITS devices such as road and lane departure warning, collision avoidance warning, vehicle-to-vehicle communication
- disseminating safety information regarding modern vehicles.

6.3.2 Improved Truck Crash Data and Reporting

One particularly important development would be to ensure that vehicle-type data for all vehicles involved in a crash are recorded in crash databases. Truck safety receives little attention in the economies visited, as it is believed they are only involved in a small number of crashes, and motorcycle and pedestrian crashes predominate. What is not clear at present is the number of those motorcycle and pedestrian crashes which are the result of a collision with a truck.

Motorcycles apart, trucks comprise a relatively high proportion of vehicles on the road in developing countries; given their large size, large mass and multiple blind spots, it would be expected that many collisions involving multiple road users involve trucks. It is considered that collating all crash data where a truck is involved would generate a different perspective on their crash involvement, and may provide some important insights.

6.3.3 Survey of Operators

To establish an understanding of current thinking, practices and typical approaches relating to safety in the logistics supply chain sector, it is considered that a survey of operators would be highly valuable. The survey should be conducted separately in each of the economies of interest, as the results of the visits clearly demonstrated that safety issues and attitudes towards them tend to be regional, and differed slightly among neighbouring economies.

The major benefit of such a survey would be the opportunity to directly test industry reactions to a number of possible actions to improve safety (such as those detailed in the compendium), in order to discover which issues are of highest priority in the operators' eyes, and gain an understanding of the extent of the attitude shift and capacity building required to achieve good safety outcomes.

The survey outcome would be helpful in identifying priorities for safety strategies, both short-term and long-term, and would help to develop a targeted approach for the implementation of safety strategies and actions.

6.3.4 *Extending to the Wider Industry*

Compared to the road transport industry as a whole, the logistics supply chain sector tends to provide safe, reliable services, and charges a higher premium accordingly. This characteristic both compels the industry sector to place higher emphasis on safety than the rest of the industry, and provides the industry with enough funds to do so.

Much will be learned from the application of the various countermeasures set out in this document, and from the development and implementation of safety strategies for the logistics chain sector. The authorities and wider industry should monitor these developments closely, to determine how well accepted and how successful the various programs have been. Successful programs, particularly low-cost measures and measures which have a beneficial effect on an organisation's profitability should be identified. Expanding these programs to embrace the wider industry would be a very effective method of improving safety for the transport sector as a whole.

7 APEC'S POTENTIAL ROLE IN ADVANCING LOGISTIC SUPPLY CHAIN HEAVY VEHICLE SAFETY

APEC has the opportunity to take the lead in advancing the safety of heavy vehicles in the logistic supply chain. While Section 6 described the actions which need to be taken to improve the safety of heavy vehicles in the logistic supply chain, this section concentrates on the role which APEC can play over the next few years in bringing this about. Promotion of heavy vehicle safety by APEC is likely to make things happen quicker than they would if left to individual economies to implement on their own. It is also likely to foster harmonisation and learning from each other's' experience. The specific actions which APEC could take are:

1. Sponsor and fund the survey of individual operators described in Section 6.3.3. This would be carried out across a number of economies. This would provide valuable information regarding the starting point in different economies and the capacity to implement new policies.
2. In partnership with governments in individual economies, sponsor workshops and seminars to promote safety awareness among operators in the logistic supply chain. These workshops should cover ecodriving, fatigue management and corporate safety programs. These topics are covered in Sections 6.2 and 6.3.
3. In partnership with governments in individual countries, make sure the hands-on training in ecodriving, fatigue management and corporate safety programs is available for the economies that choose to follow it up. This will involve preparing suitable materials (including DVDs or internet materials) and ensuring trained staff are available to deliver the training.
4. As the opportunity arises, lobby for and support the development of a globally-focused good practice manual for heavy vehicle safety, directed at all sectors of the road transport industry. Alternatively, fund the development of a similar manual for APEC countries.
5. In conjunction with Step 4, assist developing economies to establish centres of excellence in driver training as described in Section 6.2.1. Exchange of information and personnel between centres in different economies should be encouraged. Once the curriculum was fully developed and tested, the focus should be on 'training the trainer' so the benefits of the curriculum become available in all parts of the economy
6. Encourage governments in APEC economies to develop safety strategies for heavy vehicles in the logistic supply chain as described in Section 6.3.1. A workshop or conference to exchange ideas and seek opportunities for a harmonised approach, especially among neighbouring countries, may be appropriate.

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APPENDIX A PROGRAM OF VISITS

APEC HEAVY VEHICLE PROJECT

Travel Itinerary for Peter Cairney 16 July – 31 July 2011

(Melbourne / Kuala Lumpur / Bangkok / Ho Chi Minh / Melbourne)

Meetings scheduled in Malaysia

Time	Client Name/s	Meeting Venue	Contact/phone/email
Sat/Sun (16 th /17 th)	Arrive Kuala Lumpur on 16 th July Hotel: Putrajaya Shangrila		
Monday 18 th			
9 am – 12 pm	Datuk Suret Singh	Road Safety Department Ministry of Transport, Malaysia Level 2, Block D5, Complex D, Federal Government Administrative Centre 62616 PUTRAJAYA, MALAYSIA <u>9.00 – 10.00</u> Introduction by Datuk Suret, DG Road Safety Dept followed by Dr Peter’s briefing on the project <u>10.00 – 12.00</u> Interview(Group 1) – - Land Public Transport Authority (Scope: Vehicle Licensing, Permit issuance, Enforcement) - Malaysian Royal Police (Scope: Enforcement)	Sim Say Kiong Road Safety Department Malaysia Tel: 03 - 888 86723
2 – 5 pm		<u>2.00 – 5.00</u> Interview(Group 2) Public Works Department	Mr Sahipul 019-2293237

Time	Client Name/s	Meeting Venue	Contact/phone/email
		(Scope: Roadworthiness, planning and road design) - PUSPAKOM (Scope: Inspection) - Institute of Road Safety Research (MIROS) (Scope: Biomechanical and Vehicle Safety Research)	Ms Joyce 019-8682509
Tuesday 19 th			
9 am – 1 pm		<u>9.00 am – 1.00 pm</u> Interview(Group 3) - Occupational Safety and Health Dept (Scope: Safety and Health of workers in the transport sector) - Road Transport Department (Scope: Automotif Engineering, Vehicle licensing, Driver licensing and Enforcement) - Land Division(MOT) (Scope: Cross borders)	Mr Sahipul 019-2293237 Ms Joyce 019-8682509
2 – 6pm	Lee Chong Eng	Scania Truck Powermech Engineering Sdn Bhd No. 11 Jalan Pendidik, U1/31, HICOM-Gemmarie Industrial Park, 40000 Shah Alam, Selangor, Malaysia	Lee Chong Eng lee_ce@scantruck.com.my
	Captain Khoo	Transport Operator (Mr Lee's client)	
Wednesday 20 th			
Morning	Mr Goh Joon Lai, Country Manager, Linfox Malaysia		
5.50pm	Depart Kuala Lumpur - Malaysia Airline – Flight MH780 @ 5:50 pm Arrive Bangkok on Flight MH780 @ 6:55 pm Hotel: Silom Serene, 7 Soi Pipat, Silom Road, Bangkok 10500 Phone: +66 2 636 6599 Email: sserene@loxinfo.co.th		

Meetings scheduled in Thailand

Time	Client Name/s	Meeting Venue	Contact/phone/email
Thursday 21 st	Report writing		
Friday 22 nd			
11 am	Mr Sukid, Managing Director, Mr Sanguan, Senior Engineer, Mr Kittipol, Associate	Transconsult The Pann Building, 6th Floor, 125 Khlong Lam Chiak Road, Nawamin, Bueng Kum, Bangkok 10230, Thailand	Sukid sukid@transconsult.co.th +662-943-9627-31
4 pm	Mr Thongyu Khonkant, Managing Director, T.K.L. Logistics (Thailand) Co. Ltd.	TKL Logistics team 35, Soi Ramkamnaeng II (Soi 2), Bangna-Trad Rd., Dokmai, Praves, Bangkok 10250, Thailand.	Mr Thongyu Khonkant 66(0)2751-7485-8, 081-847-5789 thongyu@tk-logistics.com
	Mr Thitisak	Secretary of the Thailand Land Transport Association	
Sat/Sun (23 rd /24 th)			
Monday 25 th			
10 am	Mr James Allmand, Managing Director, Linfox M Logistics (Thailand) Ltd.	Linfox (Thailand) Ltd. 29th Floor, Thai Summit Tower, 1768 New Petchburi Road, Bangkok, Huay Kwang, Bangkok 10310, Thailand	James Allmand james_allmand@linfox.com Mob: +6689 203 9848 Tel: +662 257 0220 Fax: +662 257 0221
	1. Mr. Somwang Sudkao, Chief of Accident Analysis and Protection Division, Land Transport Safety Bureau 2. Mr. Chatree Lertrut, Chief of Personnel License and Driving License System Development Group, Land	Ministry of Land Transport 1032 Phaholyothin Road Lard Yao, Chatuchak district. Tel: 02-272-5322, 02-272-5493	Ms Orapun Jaturawit Tel: +66 2 2714808 Mobile: +66 8 14409118 o.jaturawit25@gmail.com Khun Tusanee (from OTP)

Time	Client Name/s	Meeting Venue	Contact/phone/email
	Transport Safety Bureau 3. Ms. Watinee Suwannapong, Transport Technical Officer, Land Transport Safety Bureau 4. Mr. Chuckrit Tangchaitrong, Technical Engineer, Automotive Engineering Bureau		p.wichiranon@yahoo.co.th
Tuesday 26 th 7.45am	Depart: Bangkok – Thai Airways Intl – Flight TG560 @ 7:45 am Arrive: Hanoi @ 9.35am Hotel: Movenpick Hotel Hanoi		

Meetings scheduled in Viet Nam

Time	Client Name/s	Meeting Venue	Contact/phone/email
Wednesday 27 th			
10 am	Mr Nguyen Van Thach	Viet Nam's Head of Delegation to TPT-WG from the Ministry of Transport of Vietnam Hanoi and representatives from Road Directorate of Viet Nam and Transport Safety Department. 80 TRAN HUNG DAO Street, Ha Noi	Nguyen Van Thach nvthach@mt.gov.vn Tel: 84 43 9420 261; Mobile: 0903474737
Thursday 28 th			
7.10pm	Depart: Hanoi – Vietnam Airlines – Flight VN1159 @ 7:10 pm Arrive: Ho Chi Minh City @ 9.10 pm Hotel: Kingston Hotel		
Friday 29 th			
10.00am	Simon Hildebrand Country Manager – Vietnam Tel: +84 8 3511 9650 Mobile: +84 978 062 020	Linfox Logistics – Vietnam 2nd Floor, V-Coalimex Office Building, 29-32 Dinh Bo Linh Street, Ward 24, Binh Thanh District, Ho Chi Minh City, VIETNAM	
	Mr Dinh, Managing Director	No 9 Transport Cooperative, 176 Tran Tuan Khai Street, Ward 5, District 5, Ho Chi Minh City	09 1392 6769 htx9@htx9.vn
Sat/Sun 30 th /31 st	Weekend & depart for Melbourne		

APPENDIX B QUESTIONNAIRE



APEC TPT-WG Project:

Road Safety Measures for Heavy Vehicles in APEC Transport Supply Chains (TPT 05/2010A)

Questionnaire



PROJECT BACKGROUND

Project: Road Safety Measures for Heavy Vehicles – Australia with Malaysia, New Zealand, Singapore and Thailand

Last year, Australia in consultation with Malaysia, New Zealand, Singapore and Thailand developed the project in response to directives from Transport Ministers of Australia, Malaysia, New Zealand, Singapore and Thailand who met in Melbourne, Australia in February 2010. The project also responded to chokepoint 7 (variations in cross border standards and regulations for movement of goods, services and business travellers) of the APEC Supply Chain Connectivity Framework, endorsed by APEC Leaders in 2010.

Following APEC funding approval of the project proposal early this year, the ARRB Group was selected as a suitable consultant to undertake the project for completion by the end of December 2011.

The objectives of the project are:

1. To identify road safety issues relating to heavy vehicles in selected APEC countries and any barriers that exist to improving safety.
2. To raise awareness of options to address road safety strategies relating to heavy vehicles, funding planning approaches and standards and technologies to improve safety and to address variations in cross border standards that impede the flow of goods, services and people.
3. To develop a compendium of road safety measures for heavy vehicles in the transport supply chain industry with a view to promoting a common approach in implementation and alignment of standards and learning from success stories. The compendium will include measures to address driver fatigue, a safety code of practice for heavy vehicles and a professional driver training program, initially for developing countries.
4. To arrange a workshop on project findings with a view to putting in place a mechanism to assist developing countries to build capacity to include appropriate measures in their national road safety strategies and action plans.

INSTRUCTIONS

Dear TPT-WG Colleagues,

This questionnaire contains some questions about truck safety in your country. Example answers drawn from Australian experience are shown in the middle column to clarify the information and level of detail required. Please try to provide as much of the information as possible relating to your own country, typing your answers in the right hand column.

You may not be able to provide answers to all these questions – you will see that we are unable to provide Australian data in some instances – but please try to provide as much information as you can. Please make sure you provide information sources as the project report will be more credible if these sources are cited.

Thank you in advance for your time and effort in responding to the questionnaire. Your responses will be important for the success of the project.

Your response by 31 May 2011 will be much appreciated.

Please direct any queries to:

Ms Christina Chin
Business Manager
International
ARRB Group Ltd
500 Burwood Hwy
Vermont South VIC 3133
Australia

P: +61 3 9881 1669 | F: +61 3 9803 2611 | M: 61 3 488 195 115
www.arrb.com.au

Q.1: Is there a generally accepted definition of a heavy vehicle in the regulations or procedures?

From the responses, all six economies provided a definition for 'heavy vehicle', but they varied considerably, from 2.8 tonnes in the Philippines, to 3.5 tonnes in New Zealand, 4.5 tonnes in Australia and Viet Nam, 5.0 tonnes in Malaysia and 11.0 tonnes in Japan.

Q. 2: Does your economy distinguish between rigid trucks and articulated trucks (a) for registration purposes (b) in crash records?

Four economies did make the distinction for registration purposes, but New Zealand and the Philippines did not, the latter explaining that they did not since registration was based on gross vehicle weight. Australia, Japan and New Zealand made the distinction in their crash records.

Q. 3: What is the total number of registrations of vehicles of all types?

Economy	Total vehicles (million)
Australia	16
Japan	79
Malaysia	21
New Zealand	4
Philippines	7
Viet Nam	1*

* This apparently does not include motorcycles

Q 4: How many of these are (a) articulated trucks (b) rigid trucks with a gross vehicle mass of 4.5 tonnes or more?

Economy	Articulated trucks ('000)	Rigid trucks('000)	% Articulated trucks
Australia	82	431	16
Japan	-	6,362 trucks, including articulated and rigid	n/a
Malaysia	6	619	1
New Zealand	6*	98	6
Philippines	29	328	8
Viet Nam	33	33	50

*130 of these are vehicles with a gross vehicle mass of less than 4.5 tonnes.

The composition of fleets varies. Viet Nam reports having equal numbers of articulated and rigid trucks; presumably this is because most rigid trucks weigh less than 3.5 tonnes. Articulated trucks make up 16% of the heavy vehicle fleet in Australia, 8% in the Philippines, 6% in New Zealand and 1% in Malaysia.

Q 5: What is the annual distance travelled by (a) all vehicles (b) articulated trucks (c) rigid trucks?

Economy	Distance travelled, all vehicles (million km)	Distance travelled, articulated trucks (million km)	Distance travelled, rigid trucks (million km)
Australia	215,171	6,929	8,644
Japan	745,210	-	75,960 trucks, including articulated and rigid
Malaysia	424,021	-	66,306 (trucks, including articulated and rigid)
New Zealand	39,310	-	2,520 (trucks, including articulated and rigid)
Philippines	Not available	-	-
Viet Nam	Not available	-	-

Most jurisdictions are not able to provide separate estimates of the annual distance travelled by rigid and articulated trucks. The percentage of truck travel ranges from a high of 14% in Malaysia to a low of 5% in New Zealand.

Q 6: For general access vehicles (i.e. trucks that can be driven on public roads without having to apply for a special permit) what is:

Economy	Maximum permitted gross vehicle mass	Maximum permitted length	Maximum permitted axle load	Maximum permitted height
Australia	42.5t	Rigid truck: 12.5 m Articulated: 19.0 m Rigid with trailers: 19.0 to 42.5 m	Steer axle: 6.0 t Twin steer axle: 11.0 t Tandem axle group, dual tyres 16.5 t Tri-axle group: 20.0 t	4.3 m
Japan	20.0 t	Rigid truck: 12.0 m Semi-trailer: 16.5 m Full trailer 18.0 m	Steer axle: 5.0 t Twin steer axle: 10.0 t	3.8 m
Malaysia	-	-	-	-
New Zealand	44 t	Rigid truck: 12.6 m Towing vehicles, semi- trailers: 18.0 m	Steer axle 5.4 t Twin steer axle: 10.8 Tandem axle group, dual tyres 15.5 (only for axles spaced more than 1.8 m) Tri-axle group: 18.0 (only for axles spaced more than 2.4 m)	4.25 m
Philippines	16- 48 t, depending on number of axles	Rigid vehicle with two axles: 10.0 m All vehicles with 3 axles or more: 14.0 m	Maximum axle weight 13.5 tonnes	4.0 m
Viet Nam	Not available	Rigid vehicle: 12.2 m Articulated vehicle (including semi-trailer): 20.0 m	Single axle: 10.0 t Dual and tri-axle masses are dependent on the inter-axle spacing.	4.0 m (for vehicles with mass over 5 t) Restrictions on smaller vehicles to prevent unduly

				high loads
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Arrangements are complex and differ among jurisdictions.

Q 7: What is the maximum speed permitted :

Economy	For articulated trucks	For rigid trucks
Australia	100 km/h	100 km/h
Japan	Depends on road network; 80 km/h is maximum highway speed	Depends on road network; 80 km/h is maximum highway speed
Malaysia	90 km/h	90 km/h
New Zealand	90 km/h	90 km/h
Philippines	50 km/h – country roads with no blind corners 30 km/h – on “through streets” and city roads 20 km/h – crowded streets and school zones	50 km/h – country roads with no blind corners 30 km/h – on “through streets” and city roads 20 km/h – crowded streets and school zones
Viet Nam	50 km/h	70 km/h

Speed regimes depend on the road network and vary considerably, with Viet Nam and the Philippines having low permitted maximum speeds. Only Viet Nam has different limits for articulated and rigid trucks.

Q 8: Does your economy have regulations for trucks covering:

Economy	Maximum permitted loads	Vehicle maintenance standards	Frequency of mechanical inspections	Load Security
Australia	Yes - Australian Vehicle Standards Rules (AVSR), Mass and loading national model regulations, Heavy vehicle access schemes and arrangements.	Yes – 1) Maintenance Management Accreditation Standards- NTC, 2007 ; 2) Performance Based Standards (PBS)- NTC; 3) Vehicle Roadworthiness Guidelines	This is a State-based regulations - require regular inspections	Yes – Load Restraint Guide (LRG), NTC.
Japan	Yes - Ordinance for enforcement of Road Traffic Act	Yes – Ordinance for enforcement of Road Trucking Vehicle Act	-	Yes – Ordinance for enforcement of Road Trucking Vehicle Act
Malaysia	Yes - Weight Restriction (Federal road) (Amendment) Orders 2003	Yes – Motor Vehicles (Construction and Used) Rules 1959	Yes – Once every 6 months	Yes – Weight Restriction (Federal road) (Amendment) Orders 2003
New Zealand	Yes - Land Transport Rule 41001: Vehicle Dimensions and Mass 2002	Yes – Section 6 of the Land Transport Act (1998)	-	Yes – Section 42 of the Land Transport Act (1998)
Philippines	Yes - Gross vehicle weight indicated in manufacturer's specification, provided each axle	Yes – There are existing guidelines but these are not observed generally	Yes – At least once (1) a year, and before registration	Yes – A requirement under R.A. Nr. 4136

	load does not exceed 13.5 tons.	because of inadequate inspection facilities.		
Viet Nam	Yes (no further detail provided).	Yes (no further detail provided).	-	-

Q 8 (continued...): Does your economy have regulations for trucks covering :

Economy	Driving hours	Driver log books	Transport of dangerous goods
Australia	Yes – Road Transport Reform (Driving Hours) Regulations 1999.	Yes – National Work Diary	Yes – Australian Dangerous Goods Code
Japan	Yes – Ordinance for enforcement of Labor Standards Acts	Yes – Ordinance for enforcement of the Trucking Business Act	Yes – ordinance for Enforcement of the Fire Service Act
Malaysia	Yes – Occupational Safety and Health Industry Code of Practice for Road Transport Activities 2010, Section 3 (item 3.5)	Yes – Occupational Safety and Health Industry Code of Practice for Road Transport Activities 2010, Section 4 (item 4.2)	Yes – Motor Vehicles (Construction and Use)(Vehicles Carrying Petroleum Products) Rules 1965
New Zealand	Yes – Part 4B of the Land Transport Act (1998)	Yes – Land Transport Rule 62001: Work Time and Logbooks 2007	Yes – Land Transport Rule 45001/1: Dangerous Goods 2005
Philippines	No	-	Regulations are currently being drafted
Viet Nam	-	-	-

All economies except Viet Nam have regulations covering maximum loads, vehicle maintenance standards, and load security. Only Malaysia and the Philippines reported requiring regular vehicle inspections. All economies except the Philippines and Viet Nam reported having regulations covering driving hours, driver log books and the transport of dangerous goods. The Philippines is currently drafting regulations covering the transport of dangerous goods.

Q 9: What is the minimum age at which a licence can be obtained: to drive a car, a rigid truck and articulated truck?

Economy	Car	Rigid truck	Articulated truck
Australia	17 years (provisional licence)	LR Light Rigid – 22 years MR Medium Rigid – 22 years HR Heavy Rigid - 24 years.	HC Heavy Combination- 25 years MC Multi Combination- 25 years
Japan	18 years (provisional licence)	LR Light Rigid – 21 years MR Medium Rigid – 21 years HR Heavy Rigid - 21 years.	HC Heavy Combination- 21 years MC Multi Combination- 21 years.
Malaysia	17 years (provisional licence)	Class E (Heavy motor car) – 21 years	Goods Driving Licence – 21 years
New Zealand	15 years 5 months (restricted licence). Note from 1 August 2011 this will increase to 16 years 6 months.	(MR – up to 18 tonnes) – 17 years 1 month. From 1 August 2011, 18 years 1 month, (HR) – 17 years 7 months, from 1 August 2011 18 years, 7 months.	(MC – combined vehicle of up to 25 tonnes) – (HC) – 18 years 4 months, from 1 August 2011 19 years 4 months
Philippines	17 years – for non-professional driver's	17 years – for non-professional	17 years – for non-professional driver's

	license holder 18 yrs old – for professional drivers license holder	driver's license holder 18 yrs old – for professional drivers license holder	license holder 18 yrs old – for professional drivers license holder
Viet Nam	18 years	21 years	24 years

New Zealand stands out in that it allows restricted car licences at an early age compared to other economies; this extends to the age at which rigid and articulated truck licences can be obtained. The Philippines also allows truck licences to be held from a relatively early age. Other jurisdictions generally require drivers to be 21-22 years old before they can hold a truck licence. Australia and Viet Nam require drivers to be older before they can hold an articulated truck licence, 25 in the case of Australia and 24 in the case of Viet Nam.

Q 10: What training and driving experience is required before a driver can obtain a licence for:

Economy	A rigid truck	An articulated truck
Australia	LR Light Rigid – must have held class C for 1 year ; MR Medium Rigid – must have held class C for one year HR Heavy Rigid - Must have held (a) a class C for at least two years or (b) a class LR or MR for at least one year.	HC Heavy Combination- Must have held a class MR or HR for at least one year ; MC Multi Combination- Must have held a class HC or HR for at least one year
Japan	A driver whoever drive the truck for their business must have had driving experience at least 3 year to obtain a licence for each kind of truck (including both rigid and articulated)	
Malaysia	To obtain Class E - Must held Class D competent driving licence and have held Class D licence at least one year	To obtain Goods Driving Licence – must have held Class E
New Zealand	Class 2: 2 L (Learner) – must have held a full class 1 licence for at least 6 months. 2 – must have held a 2L for at least 6 months and pass practical driving test, or hold a 2L and successfully complete an approved licensing course Class 3: 3 L (Learner) – must held a full class 2 licence for at least 6 months. 3 - must have held a 3L for at least 6 month and pass practical driving test s, or hold a 3L and successfully complete an approved licensing course	Class 4: 4 L (Learner) – must have held a full class 2 licence for at least 6 months. 4 – must have held a 4L for at least 6 months and pass practical driving test, or hold a 4L and successfully complete an approved licensing course Class 5: 5 L (Learner) – must held a full class 4 licence for at least 6 months. 5 – must have held a 5L for at least 6 months and pass practical driving test, or hold a 5L and successfully complete an approved licensing course
Philippines	Training and experience requirement for rigid or articulated truck is based on industry self-regulation. In general there are only two categories of drivers licenses: non-professional and professional.	
Viet Nam	Rigid trucks don't require years of experience	Articulated trucks need 3 years of experience for C2 level

Both Australia and New Zealand have graduated licensing schemes that require drivers to obtain experience on smaller vehicles before obtaining a licence for a rigid truck; experience driving a rigid truck is required before obtaining a licence for an articulated truck. Japan, Malaysia and the Philippines all have driving experience requirements. Viet Nam has no experience requirements for a rigid truck licence, but there are experience requirements for an articulated truck licence.

Q 11: Which organisations are responsible for developing and maintaining the regulation of trucks and truck safety?

Economy	Response
Australia	National Transport Commission (NTC), Road Transport Reform (Compliance and Enforcement) Act 2003 Department of Infrastructure, Transport, Regional Development and Local Government (DITRD LG)
Japan	Road transport bureau, MLIT
Malaysia	N/A*
New Zealand	NZ Transport Agency, Ministry of Transport
Philippines	Dept. of Transportation and Communications, Land Transportation Office, Bureau of Product Standards
Viet Nam	Ministry of Transport, Vietnam Directorate for Road, Vietnam Register, Traffic Safety Department of the Ministry of Transport

*In spite of this answer, the visit to Malaysia indicated that SPAD would be the lead agency in developing policy in this area.

Q 12: Which organisations are responsible for enforcing regulations relating to trucks and truck safety?

Economy	Road or Transport Department Officers	General duties police	Specialist traffic police	Other
Australia	State Road Authorities (weight, roadworthiness, driving hours)		Police Force - Traffic police (principally speed)	-
Japan	District Transport Bureau, MLIT	-	Prefectural Police Department	-
Malaysia	Road Transport Department, Ministry of Transport	-	Royal Malaysian Police– Traffic enforcement is under the Department of Internal Security and Public Order	Department of Occupational Safety and Health, Ministry of Human Resources, Land Public Transport Commission -
New Zealand	NZ Transport Agency vehicle safety officers (these officers also check heavy vehicle repair certifiers inspecting organisations, and take part in accident investigations involving heavy vehicles)	-	New Zealand Police, in particular the Commercial Vehicle Investigation Unit (CVIU). CVIU constables are also health and safety inspectors appointed under the Health and Safety in Employment Act 1992	-
Philippines	Dept. of Transportation and Communications Land Transportation Office Metropolitan Manila Development Authority	Philippine National Police	-	Dept. of Public Works and Highways
Viet Nam	Vietnam Directorate for Road Vietnam Register Traffic Safety Department of the Ministry of Transport	-	Traffic Police and Road Transport Inspectors,	-

In most jurisdictions, enforcement responsibilities are shared between the road authorities and the police. Some economies have a direct role for the Occupational Health and Safety authority.

Q 13 Which organisations represent the trucking industry? (please provide website, where possible)

Economy	Organisation	Website
Australia	Australian Freight Councils Network; Australian Logistics Council (ALC); Australian Trucking Association (ATA); Australian Road Train Association (ARTA)	www.freightcouncils.com.au www.austlogistics.com.au or www.ozlogistics.org www.atatruck.net.au www.arta.org.au
Japan	Japan Trucking Association	http://www.jta.or.jp/english/index.html
Malaysia	None	-
New Zealand	Road Transport Forum New Zealand; Road Transport Association NZ	http://www.rtnz.co.nz/ www.nzrta.co.nz
Philippines	Confederation of Trucks Association of the Philippines (CTAP)	-
Viet Nam	Vietnam Automobile Transport Association (VATA) Vietnam Freight Forwarder Association (VIFFAS)	-

Most jurisdictions have at least one body which represents the industry. Often, there are organisations that represent the logistics sector and shippers which could also be influential in the present context.

Q 14: Which organisations represent the road transport industry's customers? (i.e. the companies which use the road transport industry to transport their goods - please provide website, where possible)

Economy	Organisation	Website
Australia	The Agribusiness Group/Forum	-
Japan	Nippon Keidanren	-
Malaysia	Federation of Malaysian Consumers Association	Federation of Malaysian Consumers Association
New Zealand	No specific organisation. Many transport users may belong to various business organisations.	-
Philippines	Trucks and Haulers Association	-
Viet Nam	Not sure about this question	-

There are probably many more industry groups which would represent the transport interests of particular industry segments.

Q 15: Which organisations represent owner/drivers? (please provide website, where possible)

Economy	Organisation	Website
Australia	Commercial Vehicle Industry Association of Australia (CVIAA); Australian Road Transport Industrial Organisation (ARTIO); Australian Livestock Transporters Association; Transport Workers Union; Transport Women Australia	www.cviaa.com.au , www.artio.org.au , www.alta.org.au www.twu.com.au , www.transportwomen.com.au
Japan	Japan Trucking Association	http://www.jta.or.jp/english/index.html

Malaysia	Logistics and Supply Chain Association of Malaysia; Pan Malaysian Lorry Owners Association Malaysia Heavy Construction Equipment Owners' Association	www.l-scom.org
New Zealand	Combined Owner Drivers Association T/A NZ Trucking Association; National Road Carriers	www.nztruckingassn.co.nz www.natroad.co.nz
Philippines	Data not available	-
Viet Nam	None	-

Q 16: Which organisations represent drivers employed by the road transport industry? (please provide website, where possible)

Economy	Organisation	Website
Australia	Transport Workers Union; Transport Women Australia	www.twu.com.au , www.transportwomen.com.au
Japan	Japanese Council of Transport Workers Union	http://www.koun-itf.jp/index.html
Malaysia	None	-
New Zealand	New Zealand has no compulsory union membership requirement. A driver is free to select any person they so wish to represent them in bargaining or other employment-related matters. In terms of organisations that are registered trade unions those most recognised in terms of representing drivers are: Amalgamated Workers Union Northern (AWUNZ); Amalgamated Workers Union Central (AWUNZ); NZ Dairy Workers Union (DWU), National Distribution Union (NDU), Cape Foulwind Drivers, Operators and General Workers Union Inc, Pro Drive	www.awunz.org.nz www.cawu.org.nz www.nzdwu.org.nz www.ndu.org.nz capedriversunion@xtra.co.nz http://prodrive.org.nz/
Philippines	None	-
Viet Nam	Labor Union of the Ministry of Transport	

Q 17: Please describe any significant programs that have been undertaken in the last five years or so in each of the following areas:

- Improving truck driving skills
- Improving regulation of truck driving hours
- Improving safety management in trucking firms

For each program, it would be particularly helpful to say whether there has been an evaluation of the program, what the effects of the program have been, and to provide a summary and any other documentation available in English.

Economy	Improving truck driving skills	Improving regulation of truck driving hours	Improving safety management in trucking firms
Australia	National Heavy Vehicle Regulator (NHVR) National Framework for Regulation, Registration and Licensing of Heavy Vehicles- Council of Australian	Heavy Vehicle driver fatigue - which option suits you? NTC; Daily work and rest hours planner, Driver dashboard card- NTC; Advanced Fatigue	The industry-owned safety accreditation scheme, TruckSafe

	Governments (COAG)	Management- NTC	
Japan	1) Providing training course for trucking companies 2) Implementing competence test for truck driver	Prevailing and developing guidelines on assessment for driver's health control	1) Expanding the target of the assessment 2) Providing a training course for safety management 3) Information sharing among business field 4) Enhancing the high-level transport safety management system by utilizing driving view recorders and digital tachographs 5) Strengthening the administrative measures against violations of the labour standards and so on. 6) Strengthening the audit 7) Strengthening the administrative measures against violations of the labour standards, inspection standards, and so on 8) Revising the standard for audit 9) Implementing the audit to injustice reconstruction of speed limiter 10) Developing the Ordinance for Enforcement of Trucking Business Act, aimed at achieving to eliminate drunk driving. 11) Strengthening the administrative measures against drunk driving 12) Prevailing alcohol interlock devices
Malaysia	None	-	-
New Zealand	Safe and Fuel Efficient Driver - Safed (MoT) http://safednz.govt.nz/	New Part 4A to the Land Transport Act 1998 And Land Transport Rule 62001: Work Time and Logbooks 2007	Development of the Operator Safety Ratings system http://www.nzta.govt.nz/commercial/assistance/ors/-
Philippines	Data not available	-	-
Viet Nam	Traffic Safety Strategy up to 2020 and Vision to 2030.	-	-

Q 17 (continued): Please describe any significant programs that have been undertaken in the last five years or so in each of the following areas:

- **Improving safety equipment fitted to trucks**
- **Improving enforcement of safety regulations in the trucking industry**
- **Improving safety of the road environment for trucks – (these may be either particular projects or network-wide initiatives (e.g. improving signage))**
- **Any other initiative**

For each program, it would be particularly helpful to say whether there has been an evaluation of the program, what the effects of the program have been, and to provide a summary and any other documentation available in English.

Economy	Improving safety equipment fitted to trucks	Improving enforcement of safety regulations in the trucking industry	Improving safety of the road environment for trucks – (these may be either particular projects or network-wide initiatives (e.g. improving signage))
Australia	1) National Heavy Vehicle Braking Strategy, 2008, NTC 2) State Road Authorities - Safety and Heavy Vehicle Accreditation	1) The NTC developed the Compliance and Enforcement reform package aimed at achieving nationally agreed road transport safety, productivity, asset protection and environmental	

	& Audit: Transport Safety Compliance Section, Safety and Regulation Division, DTEI, South Australia; Western Australian Heavy Vehicle Accreditation Process, Main Roads WA; Tasmanian Heavy Vehicle Safety Code, DIER, Tasmania; National Heavy Vehicle Accreditation Scheme Maintenance Management, Northern Territory; Maintenance Management Accreditation Guide, New South Wales; Maintenance Management Accreditation Standards, Victoria;	reforms. The compliance and enforcement Bill (The Bill) also introduces chain of responsibility requirements. The expected outcomes include improved compliance to road transport laws, development of better enforcement tools and encourage involvement and responsibility for all parties in the supply chain. 2) The State Road Authorities' safety initiatives- e.g. Australian Road Safety Strategy (Nationwide), Towards Zero, Western Australia, Arrive Alive, Victoria, South Australia Police Road Safety Strategy 2006-2010, 3) Draft National In-vehicle Telematics Strategy: The Road Freight Sector, 2010 NTC 4) A National Framework for Regulation, Registration and Licensing of Heavy Vehicles- Council of Australian Governments (COAG)	
Japan	1) Prevailing and developing the ASV system 2) Prevailing Pre-Crash Brake System 3) Prevail digital tachographs and drive recorders	-	1) Making further effort on development of sidewalk, center divider and signal, where severe incidents are likely to occur 2) Developing sidewalks and guard fence on the route to and from school 3) Ensuring the safety on the residential road 4) Maintaining the facilities such as guard fence and curve mirror for road transport safety
Malaysia	-	-	-
New Zealand	2007 amendment to Land Transport Rule 32015: Heavy-vehicle Brakes 2006, provided for greater recognition of having compatible systems between towing vehicle and trailer It also facilitated the testing of heavy vehicle brakes with an actual or simulated load (up to 60 percent of maximum gross load). This better replicated brake performance tested during an inspection with on-road performance	NZ Police have been issued with hand-held scanners to download vehicle operator details at the roadside, so that infringements are linked to the correct transport operator. NZ Police have been provided with mobile roadside brake testing machinery. NZ Police allow only a 5km/h tolerance to trucks when checking compliance with speed limits. The normally applied tolerance is 10 km/h.	NZTA promote a 'keep it below 10' campaign on State Highway 1 between Christchurch and Picton (particularly around Kaikoura). This encourages truck drivers to travel at least 10 km/h lower than the speed advisory sign for a corner. This resulted from this area of road being prone to truck rollovers. See http://www.nzta.govt.nz/about/media/releases/656/news.html New Zealand also has seven specific Roads of National Significance, which will be engineered to be at least four-star rated. These will benefit truck operators in terms of safer roads and reduced congestion. http://www.transport.govt.nz/ourwork/Land/RoadsofNationalSignificance/ NZTA has published advice for

			Cyclists, truck drivers and bus drivers on the safe sharing of the road – Safety Tips for Cyclists and Truck and Bus drivers www.nzta.govt.nz/resources/safety-tips-cyclists-truck-bus/docs/leaflet.pdf
Philippines	-	-	-
Viet Nam	-	-	-

Australia, Japan and New Zealand appear to have been particularly active in pursuing programs to improve heavy vehicle safety.

Q 18: Please list any publications aimed at truck drivers which give advice on safe driving or any other aspects of life style or business practice which would help support safe driving.

Economy	Response
Australia	Heavy vehicle driver fatigue reform; Guidelines for Managing Heavy Vehicle Driver Fatigue - NTC; Returning Home Safely – Fatigue Information for Drivers, 2008, NTC
Japan	Guideline for container safety on road transport Manual for utilizing drive recorders
Malaysia	1. Safety, Health and Environment Code of Practice for the Transportation Sector MCP 1/2007 – MIROS (in Malay) 2. Occupational Safety and Health Industry Code of Practice for Road Transport Activities 2010 The following publications are more focused on bus drivers, but indirectly related to truck drivers: 3. Prevalence of Fatigue Among Commercial Bus Drivers in Malaysia MRR 06/2008 – MIROS 4. Fatigue Among Commercial Bus Drivers in Malaysia: Role of Driving Hours and Single Versus Two-Driver Approach MRR 07/2008 MIROS 5. An Impact Assessment of Banning Wee-Hour Express Bus Operations MRR 10/2009 MIROS 6. Obstructive Sleep Apnoea Among Commercial Bus Drivers in Malaysia MRR 14/2009 MIROS 7. Road Collisions Involving Express Buses Travelling During Wee Hours (12:00 a.m. – 6:00 a.m.) MER 04/2009 MIROS
New Zealand	Commercial Road Transport Toolkit: for drivers and operators (NZ Transport Agency) Causes and Consequences of Driver Fatigue: Findings from the Baseline Survey of Companies in the LTNZ Fatigue Management System Trial
Philippines	None
Viet Nam	Manual Driver Safety – National Traffic Safety Committee How to run the car on the highway - National Traffic Safety Committee

Q 19 – 23: How many traffic crashes in the following categories occurred in the last year for which you have data? (Please provide the number, the year and your data source)

Economy	All fatal road crashes	Fatal crashes involving all types of truck, and number of people killed separated into men and women	Fatal crashes involving rigid trucks, and number of people killed separated into men and women	Fatal crashes involving articulated trucks, and number of people killed separated into men and women
Australia	1,405 fatalities in 2010	233 in 2010 Male:162	76 in 2010 Male: 53	157 in 2010 Males: 109

		Female: 71	Female: 23	Females: 48
Japan	4,863 fatalities in 2010	410 in 2009	378 in 2009	32 in 2008
Malaysia	6,872 fatalities in 2010	Total deaths – 202 in 2010	Total deaths – 90 in 2010	Total deaths – 55 in 2010
New Zealand	337 fatal road crashes in 2010, resulting in 375 fatalities in 2010 264 male 111 female	51 fatal crashes in 2010 involving at least one truck resulted in 57 deaths 43 male 14 female	32 fatal crashes in 2010 involving at least one rigid truck resulted in 34 deaths, 26 male 8 female	20 fatal crashes in 2010 involving at least one articulated truck resulted in 24 deaths, 18 male 6 female
Philippines	64,747 crashes in Metro Manila (2003); 20,008 nationwide (Police Data)	No data available	No data available	No data available
Viet Nam	13,713 fatal crashes killed 11,060 people and wounded 10,306 people in 2010	No data available	No data available	No data available

Most jurisdictions are able to provide data on fatal crashes, separately for rigid trucks and articulated trucks; only Australia and New Zealand can provide a breakdown by gender of the persons killed.

Q 24 – 27: How many traffic crashes in the following categories occurred in the last year for which you have data? (Please provide the number, the year and your data source)

Economy	All serious injury road crashes, and number of people seriously injured separated into men and women	Serious injury crashes involving all types of truck, and number of people injured into men and women	Serious injury crashes involving rigid trucks, and number of people injured separated into men and women	Serious injury crashes involving articulated trucks, and number of people injured separated into men and women
Australia	32,777 in 2006-07 Male - 21,741 in 2006-07 Female - 11,036 in 2006-07	-	National figures are not available as the different jurisdictions use different definitions of injury. Figures are available for each jurisdiction..	National figures are not available as the different jurisdictions use different definitions of injury. Figures are available for each jurisdiction
Japan	49,145 in 2010	1791 in 2009	1646 in 2009	145 in 2009
Malaysia	7781 in 2010, Male - 6129 in 2010 Female – 1652 in 2010	Total serious injury = 162 in 2010 Breakdown by gender not available currently	Total serious injury = 71 in 2010 Breakdown by gender not available currently	Total serious injury = 39 in 2010 Breakdown by gender not available currently
New Zealand	1842 serious injury crashes in 2010, 2264 people seriously injured 1448 male 816 female	128 serious injury crashes in 2010 involving at least one truck 165 people seriously injured 112 male 53 female	90 serious injury crashes in 2010 involving at least one rigid truck 112 people seriously injured 75 male 37 female	39 serious injury crashes in 2010 involving at least one articulated truck 55 people seriously injured 38 male 17 female
Philippines	For Metro Manila only: 320 Men: 260 Women: 60	No data available	No data available	No data available

Viet Nam	No data available	No data available	No data available	No data available
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Most jurisdictions are able to provide data on serious injury crashes, separately for rigid trucks and articulated trucks (note that Australia can only do this on a jurisdiction by jurisdiction basis due to different ways of classifying injury crashes). Only Australia and New Zealand can provide a breakdown by gender of the persons killed.

Q 28: Are breakdowns by crash type available (e.g. rear-end crash, run-off-the –road crash, head-on crash)?

Economy	Response
Australia	Yes – State Road Authority databases have this information, but consolidated national figures are not available.
Japan	Yes-The most frequent crash type is rear end crash, the second one is encounter head accident, the third one is head-on crash
Malaysia	Yes
New Zealand	Yes
Philippines	No data available
Viet Nam	No data available

Most jurisdictions are able to provide this data (note that in the case of Australia, this is possible only on a state by state basis, due to different methods for categorising crash types).

Q 29: Is there any report available which describes the nature of the truck crash problem in your economy? Please provide a copy of any documentation available in English to the research team.

Economy	Response
Australia	The main issues for Australia are: increased seatbelt usage by heavy vehicle drivers; safer roads; more effective speed management; reduced driver impairment; and safer heavy vehicles.
Japan	The main issues for Japan are: ☐ Improving transport safety management ☐ Providing thorough instruction in compliance ☐ Eliminating drunk driving ☐ Utilizing new technology and IT ☐ Improving safety of the road environment
Malaysia	The main issues for Malaysia are: • rear underrun protection star rating • rear end collision and crash compatibility • heavy vehicle in-depth crash investigation • vehicle overloading
New Zealand	The main issues for New Zealand are: • pre-2007 brake-related truck crashes were considered to be the single largest cause of truck crashes • dealing with increased amount of freight over the next 20 years (expected to double), 70-75 percent of the expected

	increase will need to be carried by truck. Meeting this demand requirement and maintaining good safety outcomes.
Philippines	No data available
Viet Nam	No data available

A range of concerns was identified in different economies. No publications detailing safety concerns were received.

Q 30: Is there any agreed estimate of the cost of all traffic crashes occurring in your economy which is used in economic evaluations?

Economy	Response
Australia	The social cost of road crashes was an estimated \$17.85 billion and \$27 billion in 2006 using the human capital approach and the willingness to pay approach respectively
Japan	No information available
Malaysia	The social cost of road crashes was estimated at RM 8.9 billion in 2007 as published by JKJR. The evaluations adopted the injury values from willingness to pay approach. The unofficial estimated total cost for 2010 is at RM 9.3 million. Since property damage cost is not yet available, these total crash costs from 2007 and 2010 has not included damage-only crashes. No report from MIROS is available on this evaluations
New Zealand	The total social cost of motor vehicle injury crashes in 2009 is estimated at approximately \$3.67 billion, at June 2010 prices. This estimate includes both reported and non-reported casualties. The cost of pain and suffering due to the loss of life from a road crash is estimated using the willingness-to-pay-based value of statistical life (VOSL). The VOSL is \$3.56 million, at June 2010 prices.
Philippines	1.7% loss in the Philippines GDP annually due to road crashes.
Viet Nam	The social cost of road crashes was an estimated 2% of GDP.

Surprisingly, Japan is the only economy which indicated it did not have an estimate of the total cost of road crashes. The percentage of GDP indicated for the Philippines and Viet Nam (1.7% and 2% respectively)) is consistent with the percentage of GDP in Australia (2%).

Q 31: Is there any agreed estimate of the cost of a fatal crash which is used in economic evaluations?

Economy	Response
Australia	Estimated cost per fatal crash \$2.67 million in 2006, using a human capital approach
Japan	No information available
Malaysia	Estimate is available per fatality and not per fatal crash. Current used value is RM1.2million per fatal injury. Latest value of RM 1.3 million per fatality at 2008 price is not yet adopted in economics evaluation. Both values however used willingness-to-pay approach.
New Zealand	The estimated average social cost per fatal crash is \$4,204,000 (June 2010 prices).
Philippines	No data available
Viet Nam	No data available

Australia and New Zealand have estimates per fatal crash, and Malaysia has estimates per fatality.

Q 32: Is there any agreed estimate of the cost of a serious injury crash which is used in economic evaluations?

Economy	Response
Australia	Estimated \$266,000 in 2006 (BITRE 2006)
Japan	No data available
Malaysia	Estimate is available per person injured and not per crash. Current used value is RM120 000 per serious injury. Latest value of RM 0.64 million per serious injury at 2008 price is not yet adopted in economics evaluation. Both values however used willingness-to-pay approach.
New Zealand	The estimated average social cost per serious injury crash is \$446,100 (before adjusting for the level of non-reporting) and \$765,000 (after adjusting for the level of non-reporting). Both estimates are in June 2010 prices
Philippines	No data available
Viet Nam	No data available

Australia and New Zealand have estimates per serious crash, and Malaysia has estimates per serious injury.

Q 33: Is there any agreed estimate of the cost of a traffic crash averaged over all severities which is used in economic evaluations?

Economy	Response
Australia	This information is not available from the BITRE report. However, a property damage only crash is estimated to cost \$9,950.
Japan	No data available
Malaysia	Evaluations were done by injuries and only subjective cost of injury is available for the current use. Other costs (loss output, property damage, etc.) are not available or are still a part of on-going MIROS studies.
New Zealand	The estimated average social cost per injury crash over all injury severities is \$327,000 (after adjusting for the level of non-reporting), at June 2010 prices.
Philippines	No data available
Viet Nam	No data available

Only New Zealand has an estimated cost per casualty crash, averaged over all severities.

Q 34: What is the estimated cost of truck crashes to your economy?

Economy	Response
Australia	Estimated truck crash costs \$3 billion per annum. Heavy vehicles crashes are estimated to cost 50% more than other crashes at the same level of severity
Japan	No data available
Malaysia	-
New Zealand	The social cost of truck crashes in 2009 was \$375 million (June 2010 prices).
Philippines	-
Viet Nam	-

Australia has an estimate of the relative cost of truck crashes compared to other crashes; only New Zealand has an estimate for the total cost of truck crashes to the economy. This appears to be equivalent to approximately 0.3% of GDP.

Q 35: Please indicate how much of problem each of the following issues is for your economy by placing an X to the right of the appropriate letter e.g. HX) in the middle column.

(High = major issue, Medium = some concern, but not a major issue, and Low = minor issue).

Please indicate the three most important issues for truck safety in your economy. In the right hand column, type '1' against the issue you consider to be most important for your economy, '2' against the next most important, and '3' against the third most important issue.

Issues	Australia	Japan	Malaysia	New Zealand	Philippines	Viet Nam
Low driver skills	-	H	H	H	1	H
Poor vehicle maintenance	-	H	M	L	3	M
Driver fatigue/insufficient regulation of driving hours	-	2	M	2	2	H
Overloading	-	H	1	3 (note this is mainly around overloading in excess of road user charges weights rather than maximum gross weights)	H	H
Driver drug use	-	M	L	L	H	M
Excessive vehicle speeds	-	H	2	1 (note this is particularly around excessive speeds on corners)	H	H
Companies placing unrealistic demands on	-	3	3	M	H	M

drivers						
Bad behaviour towards trucks by other road users	-	L	L	L	H	M
Insufficient provision for trucks on primary road network (e.g. turning space, overtaking lanes)	-	L	H	M	H	M
Insufficient provision for trucks on minor road network (e.g. turning space, unloading areas)	-	L	H	M	H	M
Poor road maintenance	-	L	M	L	M	M
Other (please specify)	-	1. Bad Driving Attitude	-	-	-	-

There was little consistency in the way respondents distributed the 1, 2 and 3 ratings indicating their most pressing problems. What is clear from the ratings is that low driver skills, poor maintenance, driver fatigue, overloading were regarded as high priority issues by all respondents. Drug use and insufficient provision for trucks on both major and minor roads, and poor road maintenance were rated as issues which were lower priority, generally attracting a mixture of 'high' and 'medium' priorities. Bad behaviour of other road users was generally not seen as a problem. One respondent volunteered 'bad driving attitude' as a problem,

Q 36: Issues relating to border crossing are of interest in the present project. For example, if a driver has been driving for five hours before he crosses a border, does this affect the number of hours he is allowed to continue driving in the country he has just entered? For each of the issues listed, please indicate whether this is an issue which authorities manage, and give a brief account of the measures where appropriate

Issues	Australia	Japan	Malaysia	New Zealand	Philippines	Viet Nam
Overloading	As Australia has no land borders, no measures are necessary	As Japan has no land borders, no measures are necessary	Yes. Management and control done by SPAD	As New Zealand has no land borders, no measures are necessary	-	-
Driving hours	-	-	Enforced to public service vehicles only	-	-	-
Drug affected drivers	-	-	Yes. The Director General may suspend or revoke the driver's license if he has reason to believe that such person is a drug dependant	-	-	-

Vehicle roadworthiness	-	-	Yes. Commercial vehicles are subject to periodic inspection of every six month to ensure that the vehicles are roadworthy	-	-	-
Vehicle length, breadth and height	-	-	Yes. Subject to: Weight Restriction (Federal road) (Amendment) Orders 2003, Weight Restriction (Federal road) (Amendment) Orders 2003, Motor Vehicles (Construction and Used) Rules 1959	-	-	-
Dangerous goods carried	-	-	Yes. Subject to Motor Vehicles (Construction and Use)(Vehicles Carrying Petroleum Products) Rules 1965	-	-	-

Only Malaysia reported on measures to deal with cross-border issues. Four of the respondents were island nations where border crossing issues would not arise.

