



Australian Government

Australian Transport Safety Bureau

**Heavy Truck Crashes
at 500 to 1499 Kilometres Outward Distance from Base
1998 to 2002**

ROAD SAFETY WORKING PAPER

FEBRUARY 2004

The Australian Transport Safety Bureau (ATSB) is an operationally independent multi-modal Bureau within the Commonwealth Department of Transport and Regional Services. The ATSB's objective is safe transport. It seeks to achieve this through: open and independent no blame investigation; safety data analysis; and safety communication and education.

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CONTENTS

1	EXECUTIVE SUMMARY	1
2	INTRODUCTION	3
3	RESULTS	5
3.1	Crashes at intervals of outward distance from base	5
3.1.1	1998 to 2002 average annual crashes	6
3.1.2	1998 to 2002 crashes by year	7
3.2	Crashes by time of day	7
3.2.1	1998 to 2002 crashes	7
3.2.2	Crashes by time sector, 1998 to 2002	9
3.2.3	2000 to 2002 major crashes	10
3.3	Crashes by CRASH type	11
3.4	Crashes by crash type and time of day	14
3.4.1	Rear end or failure to give way collisions	14
3.4.2	Turning, merging and lane changing collisions	16
3.4.3	Collisions with animals or trains, jackknife or tyre failure incidents	17
3.4.4	'Hit beast' crashes	17
3.4.5	Crashes resulting from possible fatigue-or-speed related incidents	19
3.4.6	'Ran off road' and 'Driver fatigue' crashes	22
3.5	Crashes by freight task and time sector	23
3.5.1	Proportion of major crashes by freight task	28
3.6	CRASHES BY FREIGHT TASK, CRASH TYPE AND TIME OF DAY	29
3.6.1	'General carrier' all crashes	29
3.6.2	'Refrigerated carrier' all crashes	30
3.6.3	'Driver fatigue' crashes	31
4	CONCLUSIONS	34

1 EXECUTIVE SUMMARY

In 2001, National Transport Insurance Ltd (NTI) volunteered to forward heavy truck crash data to the Australian Transport Safety Bureau (ATSB) for analysis. This report looks at NTI truck crash claims for 1998 to 2002. In an attempt to capture crashes predominantly involving the long-distance truck fleet, the analysis was confined to incidents where trucks were at least 500 kilometres outward distance from base. To eliminate the straggle of crashes at very long distances from base, a cut-off point of 1499 kilometres outward distance from base was used. The NTI data show that approximately

88 per cent of NTI crashes occurred within 500 kilometres from base;
2 per cent occurred at distances of 1500 kilometres or more; and
the remaining 10 per cent of crashes, of which nearly three-quarters were on an outward leg of a trip, were in the 500-1499 kilometres from base range.

Knowing the outward distance from base means that it is possible to roughly estimate the number of hours a truck had been on the road prior to the crash.

The NTI data did not include details of injuries - fatal or otherwise - sustained by anyone involved in the crashes; therefore, for the purposes of this paper, any crash that incurred a claim of \$10 000 or more has been defined by ATSB as a *major* crash. Over the 1998 to 2002 period:

38 per cent of NTI truck crashes in the 500-1499 kilometres outward distance from base range fell into the *major* crash category.

Peaks in *major* crashes occurred at 900-999 and 1100-1199 kilometres outward distances. For *all* crashes (ie. major plus non-major crashes), peaks occurred at 900-999 and 1200-1299 kilometres outward distances, although in 2002 a shift had begun to manifest whereby crashes had declined at 900-999 kilometres and increased at 1100-1199 kilometres outward distance from base.

The majority of crashes occurred during the day.

60 per cent of *major* crashes occurred during the day, and
70 per cent of *all* crashes occurred during the day.

For both *major* and *all* crashes, the greatest proportion of crashes occurred during the morning quarter - 6am to noon - of a full day. The hours between 5am-7am appear to have been a particularly critical time for *major* truck crashes in the most recent two years of the data set, although there was also a noticeable peak at 10am in 2002, and at 7pm in 2001. Over the most recent three years, a shift in the time sector of *major* crashes was apparent. By 2002:

major crashes in the noon-6pm sector had halved (falling from 20 to 10 crashes), and
major crashes between midnight-6am had almost doubled (increasing from 11 to 20 crashes).

For *major* crashes, the dominant crash types were:

'Ran off road' (28 per cent), followed by
'Hit third party in rear' (12 per cent).

The two dominant crash types were reversed in *all* crashes, whereby:

'Hit third party in rear' was the most predominant (22 per cent), followed by 'Ran off road' (14 per cent).

The group of crash types gathered together to loosely form the possible fatigue-or-speed related crashes ('Ran off road', 'Failed to take bend', 'Rolled due to driver error', 'Driver fatigue', 'Head on collision' and 'Excessive speed') accounted for:

52 per cent of *major* crashes; and
27 per cent of *all* crashes.

Most rear end or failure to give way collisions (82 per cent) were *not major* crashes and most occurred between 6am-6pm (83 per cent). Similarly, the majority of turning, merging and lane changing incidents (87 per cent) were *not major* crashes and most occurred between 6am-6pm (77 per cent). Approximately half the collisions with animals or trains, jackknife or tyre failure incidents were *major* crashes and almost half occurred between 6am-6pm. Most of the crashes involving animals occurred overnight – particularly between 6pm-midnight. Cattle were involved in well over half the *major* crashes with animals.

Looking at the possible fatigue-or-speed related crashes:
over three-quarters of these were categorised as *major* crashes;
nearly 60 per cent of *all* possible fatigue-or-speed related crashes occurred between 6am-6pm,
and over half of these crashes were 'Ran off road' crash type; and
the most critical time for possible fatigue-or-speed crashes appeared to be between 3am-8am.

Interestingly, while the number of *all* crashes in the 500-1499 kilometres outward distance range decreased substantially in 2001, the possible fatigue-or-speed related crashes peaked in that year. That is, during 2001 the possible fatigue-or-speed related crashes, on average, increased slightly while other crash types reduced in volume. Possible fatigue-or-speed related crashes were more predominant during the months of August to December with a noticeable peak in August.

The majority of *all* crashes in the individual freight carrier categories occurred between noon-6pm, the only notable exception being 'Tipping' crashes, which occurred predominantly between 6am-noon. However, if looking at only *major* crashes, the majority of crashes for most of the different freight carrier categories occurred in the 6am-noon sector.

It would appear that in truck crashes where driver fatigue was assessed as being implicated, the later in the day that the trip began, the shorter was the distance covered prior to the crash.

2 INTRODUCTION

National Transport Insurance Ltd (NTI) is reported to insure about 40 per cent of the Australian heavy truck fleet. In 2001, NTI kindly volunteered data to the Australian Transport Safety Bureau (ATSB) for analysis. The first batch of data received covered 1996 to 2000. Data for 2001 and 2002 were subsequently forwarded a few months into the following year for each. Over time, the 1996 and 1997 datasets were found to be incomplete and were therefore discarded. As insurance claims cover incidents other than road crashes, the 1998-2002 dataset was culled to remove those cases which did not appear to be road crashes; for example, flood damage, rolled whilst tipping, damage whilst unloading, stolen vehicle/equipment, malicious damage, etc.

For the five-year period 1998-2002:

65 per cent of crashes occurred within 100 kilometres from base;
77 per cent of crashes occurred within 200 kilometres from base
88 per cent occurred within 500 kilometres from base;
10 per cent occurred in the 500-1500 kilometre range from base; and
2 per cent occurred at a distance of 1500 kilometres or more from base.

In an attempt to capture crashes predominantly involving the long-distance truck fleet, the analysis was confined to truck crashes between 500-1499 kilometres outward distance from base, that is, crashes at 6 to 18 driving hours into the trip (assuming an overall trip average of 83 kilometres per hour). This captured about 7 per cent of the culled NTI dataset.

The NTI data forwarded to ATSB did not include information on occupant injury status, therefore a claim of \$10 000 was taken as the minimum point for which a crash could be considered of a serious nature. Consequently, in many instances, two categories of crashes are looked at in this paper:

all crashes; and
major crashes; that is, those crashes for which the total claim was \$10 000 or more in vehicle damages.

3 RESULTS

3.1 CRASHES AT INTERVALS OF OUTWARD DISTANCE FROM BASE

Table 1 gives a breakdown of *major* and *all* truck crashes, in the 500-1499 kilometres outward distance from base range, for each year between 1998-2002. The significant reduction in truck crashes in 2001 was reversed in 2002. A significant drop in crashes in 2001, followed by subsequent peak in 2002, was also observed in the Australian Transport Safety Bureau (ATSB) data for fatal crashes involving articulated trucks (ATSB Monograph 15: Articulated Truck Fatalities). The proportion of NTI *major* truck crashes ranged between 32 per cent (in 1999) and 44 per cent (in 2001). The proportion for 2002 was 38 per cent – which was also the overall average for the five years.

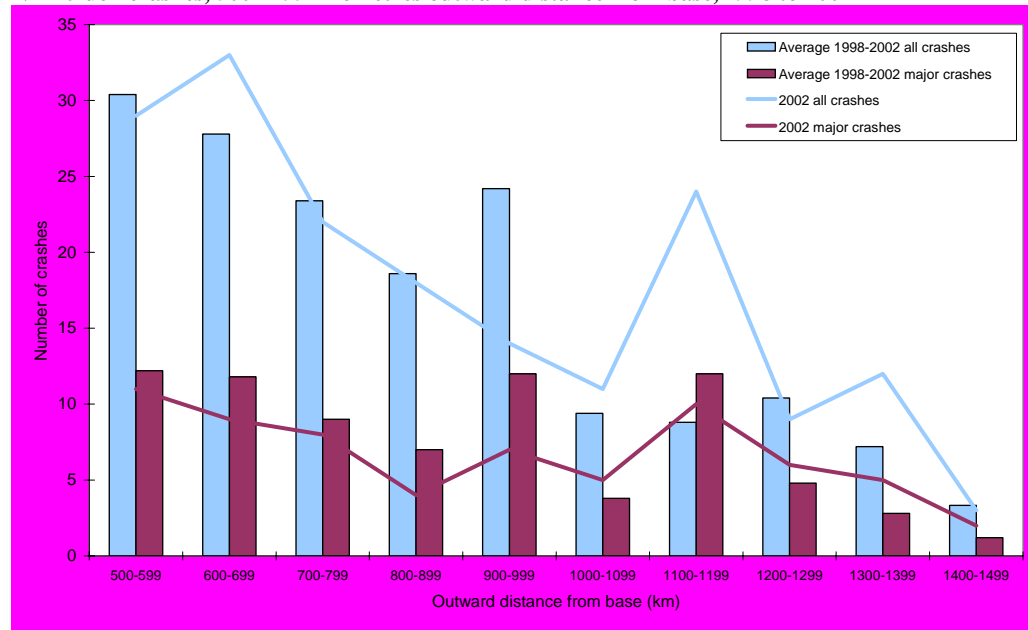
TABLE 1.
NTI truck crashes, 500-1499 kilometres outward distance from base, 1998 to 2002

Outward distance (km)	ALL CRASHES					MAJOR CRASHES				
	1998	1999	2000	2001	2002	1998	1999	2000	2001	2002
500-599	37	31	37	18	29	13	13	13	11	11
600-699	28	26	23	29	33	9	12	14	10	9
700-799	25	22	26	22	22	13	10	10	4	8
800-899	21	30	13	11	18	9	8	7	7	4
900-999	21	41	29	16	14	5	6	11	6	7
1000-1099	11	5	11	9	11	5	0	5	4	5
1100-1199	4	2	7	7	24	0	0	1	7	10
1200-1299	11	9	17	6	9	5	3	6	4	6
1300-1399	5	2	5	12	12	2	1	2	4	5
1400-1499	4	3	1	2	3	1	2	0	1	2
Total	167	171	169	132	175	62	55	69	58	67

Overall, as the distance from base increased the number of truck crashes declined. Underlying truck numbers are not available; however, it seems reasonable to assume that as the distance from base increased the number of trucks travelling these longer distances also declined.

When comparing total annual crashes, one needs to be aware that NTI's actual insured numbers increased by 19 per cent between 2000 and 2002, thus accounting in some way for the growth in crash numbers. In fact, NTI has advised that the *all* crashes frequency rate of 8.5 per cent in 2000 had declined to 7.5 per cent in 2001 and further declined to 6.5 per cent in 2002.

FIGURE 1.
NTI truck crashes, 500-1499 kilometres outward distance from base, 1998 to 2002



3.1.1 1998 to 2002 average annual crashes

Major crashes Average annual *major* crashes for 1998 to 2002 registered rises at the 900-999 kilometre and 1100-1199 kilometre marks (figure 1). Assuming that trucks had remained within speed limits (that is, averaging about 83 kilometres per hour overall for the trip), the 900-999 kilometre distance was 11-12 driving hours into the trip. The increase in crashes at the 1100-1199 kilometre distance reflected crashes at 13-14 driving hours, that is, either near the end of the first day's drive, or perhaps within the first few of hours of the second leg of the trip.

All crashes Average annual *all* crashes for 1998 to 2002 also registered a rise at 900-999 kilometres (11-12 hours), with a secondary rise at 1200-1299 kilometres (14-15 hours) outward distance from base (figure 1).

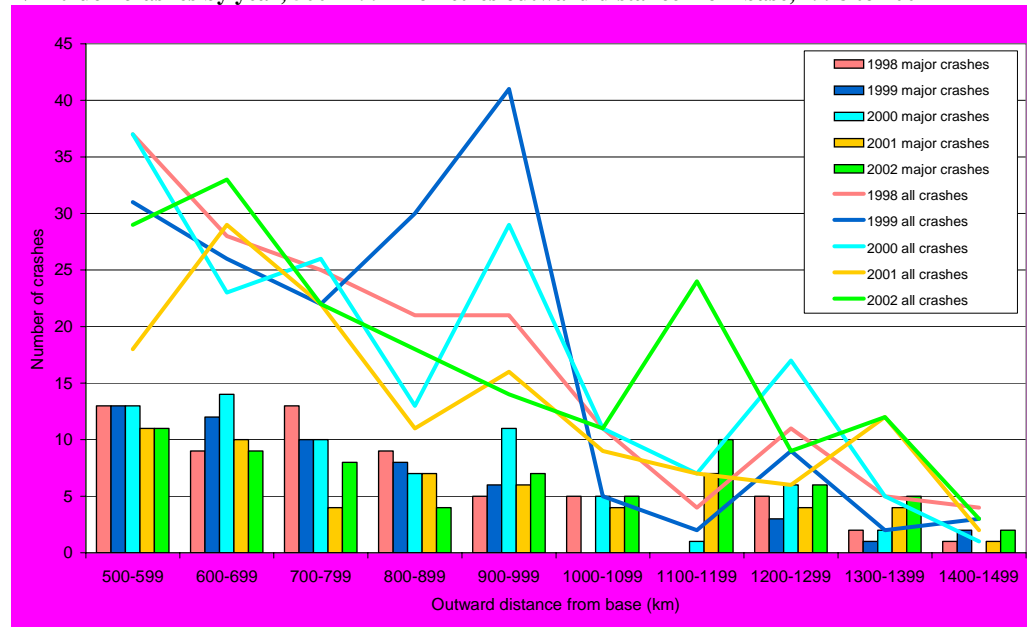
The graph also indicates that while the 2002 *major* crashes at the various outward-bound stages tended to follow the trend for the average over the five years. On the other hand, *all* crashes in 2002 showed some noticeable fluctuations from the five year average, for example, fewer crashes at 900-999 kilometres and more crashes at 1100-1199 kilometres.

The difference between *all* crashes and *major* crashes is the number of crashes for which a vehicle insurance claim was less than \$10 000.

3.1.2 1998 to 2002 crashes by year

Figure 2 tracks *major* and *all* truck crashes over 100 kilometre segments in the 500-1499 kilometres outward distance from base range for each year between 1998 to 2002. It shows that over the past five years there have been some shifts in the clustering of crashes over the different distances.

FIGURE 2.
NTI truck crashes by year, 500-1499 kilometres outward distance from base, 1998 to 2002



Major crashes Most notable was the significant increase in **major** crashes at 1100-1199 kilometres outward distance from base in recent years. Crashes in 2001 and 2002 were fewer in the 500-899 kilometre sections, and generally greater in the 1100-1499 kilometre sections, compared with the years 1998 to 2000.

All crashes *All* crashes had noticeable peaks between 800-999 kilometres in 1999; at 900-999 and 1200-1299 kilometres in 2000; and at 1100-1199 kilometres in 2002.

The pre-2002 peaks that occurred at 900-999 kilometres appear to have moved to 1100-1199 kilometres in 2002. The pre-2001 peaks at 1200-1299 kilometres appear to have moved to 1300-1399 kilometres in 2001 and 2002 with possibly some having moved to 1100-1199 kilometres in 2002.

3.2 CRASHES BY TIME OF DAY

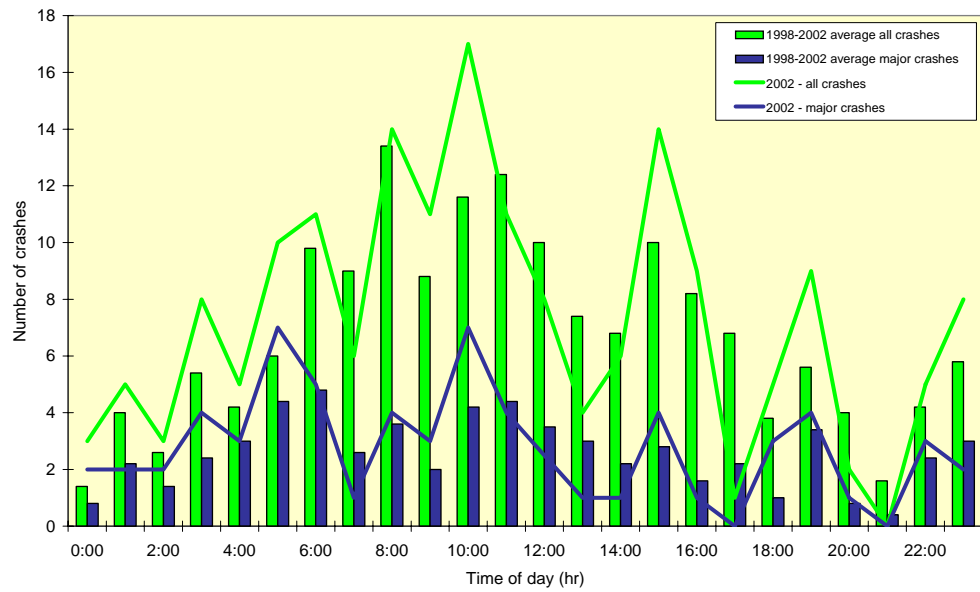
The data comparing number of crashes by time of day have been smoothed to eliminate the bunching effect at noon caused by the NTI system automatically defaulting the time to noon when a crash time was not recorded. Crash times have been truncated to the hour; for example, 6:00am represents crashes that occurred between 6:00am-6:59am.

3.2.1 1998 to 2002 crashes

As seen in figure 3, both *all* and *major* crashes for 1998-2002 followed generally similar trends of peaks and troughs over the full day; however, there was a greater proportion of *non-major* crashes between the daytime hours of 6am-6pm. Sixty per cent of *major* truck crashes occurred during the daytime hours, compared with 70 per cent of *all* crashes.

FIGURE 3.
NTI truck crashes by time of day, 500-1499 kilometres outward distance from base,

1998 TO 2002



Without data indicating how many NTI-insured trucks were on the road at any given time, it is not possible to know with any certainty whether the proportion of crashes were over-represented for any particular sector of the day.

On the other hand, much of the long-distance fleet would be operational fairly continuously around the clock. As this study only looks at crashes at a minimum outward distance of 500 kilometres from base, one could conjecture that the majority of the crashes involved trucks that were in the business of long-distance transport and thus would be driven round the clock.

3.2.2 Crashes by time sector, 1998 to 2002

When the day is broken into four 6-hour sectors (midnight-6am covers 0:00-5.59, 6am-noon covers 6:00-11.59, etc), the largest proportion of crashes occurred between 6am-noon, with the next largest proportion having occurred between noon-6pm (table 2).

TABLE 2.
NTI all and major crashes by time sector, 500-1499 kilometres outward distance from base, 1998 to 2002

CRASHES BY TIME SECTOR				
	Midnight-6am	6am-noon	Noon-6pm	6pm-midnight
Major crashes	71	108	77	55
All crashes	118	325	246	125
PROPORTION OF CRASHES BY TIME SECTOR				
	Midnight-6am proportion	6am-noon proportion	Noon-6pm proportion	6pm-midnight proportion
Major crashes	0.23	0.35	0.25	0.18
All crashes	0.14	0.40	0.30	0.15

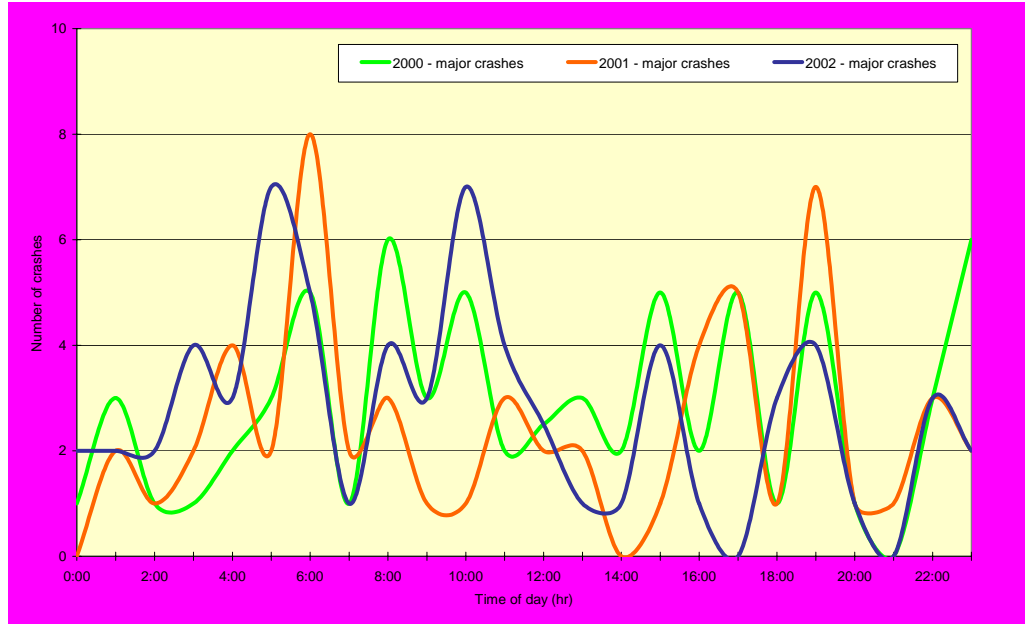
Note: Proportions may not add to 1.00 due to rounding factors.

Looking at **all** crashes, the crashes in the two night-time sectors were almost identical, at about 15 per cent each. However, for **major** crashes the midnight-to-dawn sector was higher than for the early-evening-to-midnight sector, 23 per cent versus 18 per cent. This would appear to indicate that, particularly for **major** crashes, factors come into operation during the midnight-to-dawn sector that negate the advantages to be gained by lower traffic densities during these hours.

3.2.3 2000 to 2002 major crashes

Figure 4 shows the shifting pattern of hourly *major* crashes over the years 2000-2002. The hours between 5am-7am would appear to be a generally critical time for truck crashes. In 2002, 10am was also a critical time, comparable to 7pm in 2001.

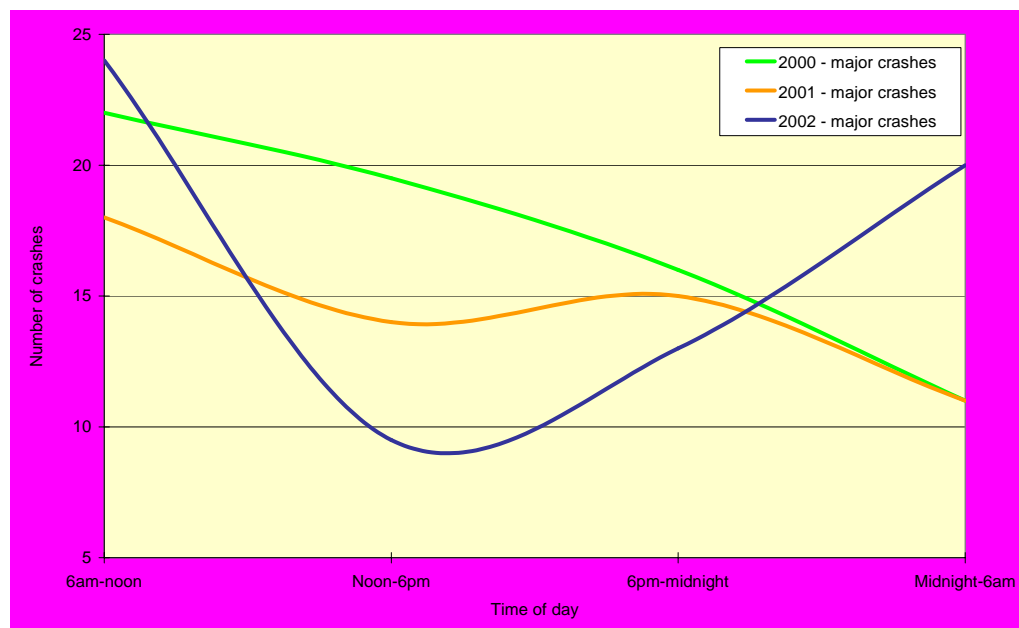
FIGURE 4.
NTI major truck crashes by time of day, 500-1499 kilometres outward distance from base, 2000 to 2002



The shifting pattern of *major* truck crashes becomes more obvious in figure 5 and table 3 where the crashes were aggregated into 6-hour sectors. In 2000 the pattern indicated a gradual decline in crashes following the high in the 6am-noon sector. In 2001, crashes had reduced in the morning sector, risen marginally in the 6pm-midnight sector before declining again overnight. By 2002, the afternoon dip had become even more pronounced while crashes in the midnight-6am sector had increased significantly.

The increase in *major* crashes in the midnight-6am time sector is not necessarily attributable to poorer driver concentration or greater risk-taking. It could be the result of increased traffic by trucks and other vehicles during this time span.

FIGURE 5.
NTI major truck crashes by time sector, 500-1499 kilometres outward distance from base, 2000 to 2002



The overall reduction of NTI **major** truck crashes in 2001 (table 3) mirrors an Australian Transport Safety Bureau database tally of fatal crashes involving articulated trucks, where a notable reduction was also recorded in 2001, before a swing back to more numerous crashes in 2002 (ATSB Monograph 15: Articulated Truck Fatalities).

TABLE 3.
NTI major crashes by time sector, 500-1499 kilometres outward distance from base, 2000 to 2002

MAJOR CRASHES BY TIME SECTOR				
	Midnight-6am	6am-noon	Noon-6pm	6pm-midnight
2000	11	22	20	16
2001	11	18	14	15
2002	20	24	10	13

PROPORTION OF MAJOR CRASHES BY TIME SECTOR				
	Midnight-6am proportion	6am-noon proportion	Noon-6pm proportion	6pm-midnight proportion
2000	0.16	0.32	0.28	0.23
2001	0.19	0.31	0.24	0.26
2002	0.30	0.36	0.14	0.20

Note: Proportions may not add to 1.00 due to rounding factors.

3.3 CRASHES BY CRASH TYPE

The proportion of the various crash types differs between **major** and **all** crashes.

Major crashes The dominant crash type for **major** crashes was 'Ran off road' (28 per cent), followed by 'Hit third party in rear' (12 per cent) (figure 6).

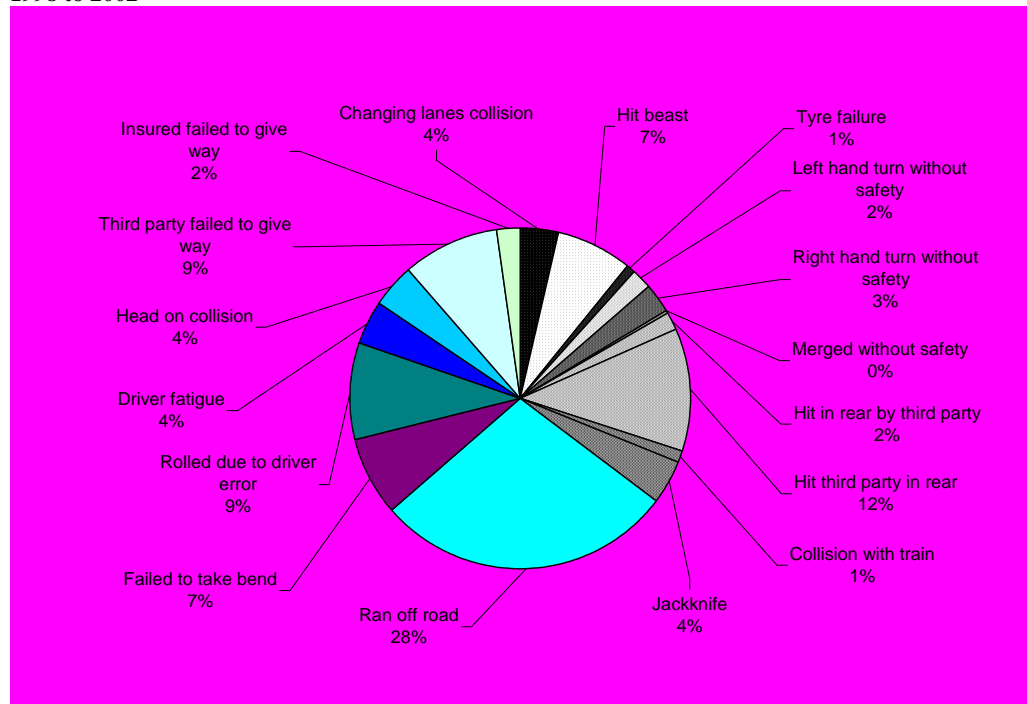
The possible fatigue-or-speed related crash types:

- Ran off road
- Failed to take bend

- Rolled due to driver error
- Driver fatigue
- Head on collision
- Excessive speed

accounted for 52 per cent of the crash types in *major* crashes. It should be remembered that any alleged fault in these crash types was not necessarily attributable to the truck driver. For instance, in most 'Head on collisions' the third party vehicle was reported to have veered into the path of the truck. On the other hand, as third party details are not available, it is possible that on at least some occasions the third party may have been a truck not insured by National Transport Insurance Ltd.

FIGURE 6.
NTI major truck crashes by crash type, 500-1499 kilometres outward distance from base, 1998 to 2002

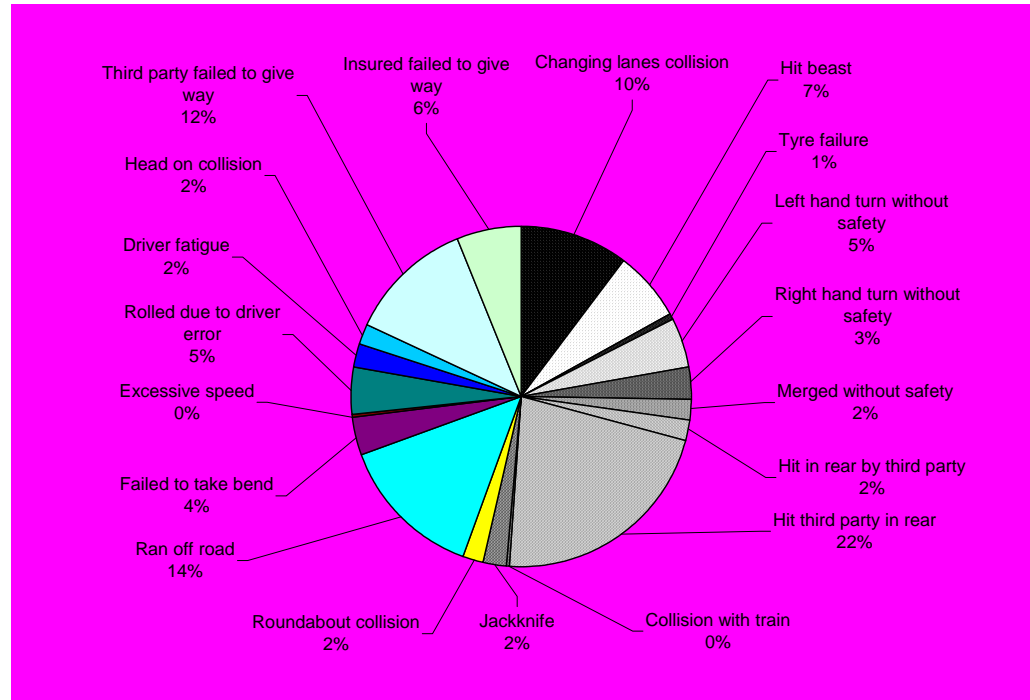


Note: Rates of 0% indicate the value was less than 0.5%.

All crashes The dominant truck crash type for *all* crashes was 'Hit third party in rear' (22 per cent), followed by 'Ran off road' (14 per cent) (figure 7).

The possible fatigue-or-speed related crash types accounted for 27 per of the crashes – almost half the rate calculated for *major* crashes – indicating that the possible fatigue-or-speed related crashes tended to incur higher damage costs.

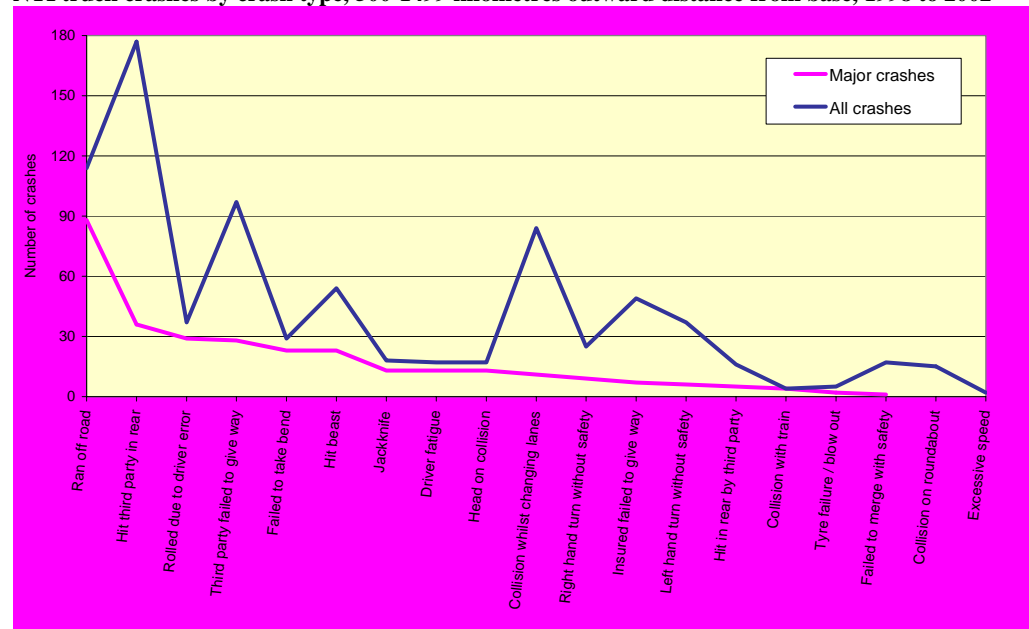
FIGURE 7.
NTI all truck crashes by crash type, 500-1499 kilometres outward distance from base, 1998 to 2002



Note: Rates of 0% indicate the value was less than 0.5%.

Major crashes versus all crashes All four ‘Collision with train’ incidents were *major* crashes. The majority of ‘Ran off road’, ‘Rolled due to driver error’, ‘Failed to take bend’, ‘Jackknife’, ‘Driver fatigue’, ‘Head on collision’ and ‘Tyre failure/blow out’ incidents resulted in *major* crashes. Figure 8 outlines *major* and *all* crashes based on a descending tally of the *major* crash types.

FIGURE 8.
NTI truck crashes by crash type, 500-1499 kilometres outward distance from base, 1998 to 2002



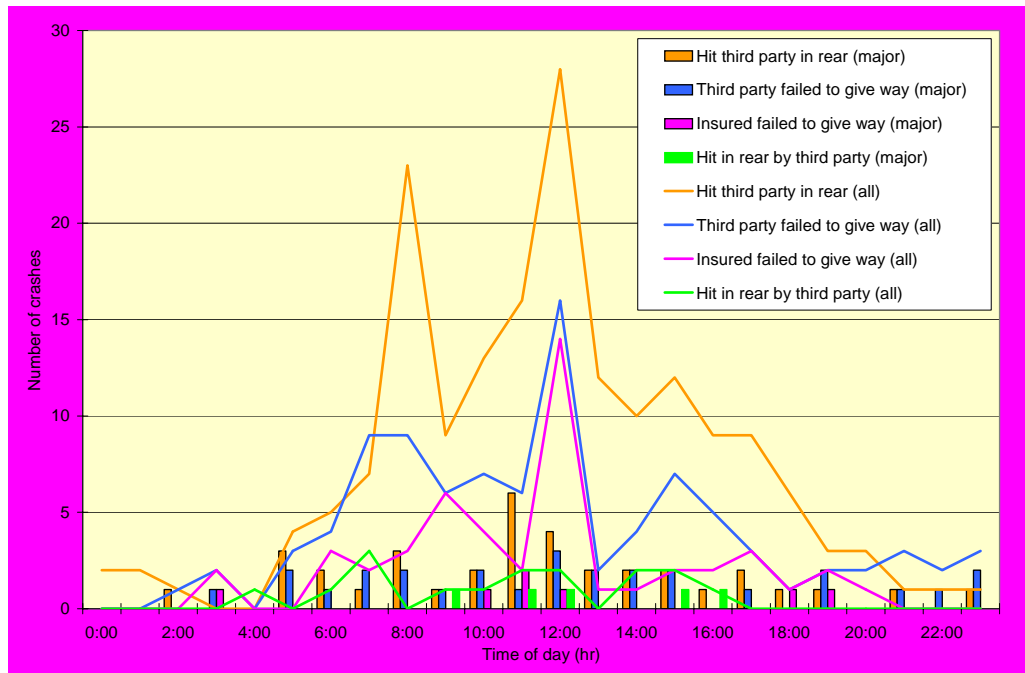
3.4 CRASHES BY CRASH TYPE AND TIME OF DAY

When looking at crash types by time of day, it is important to remember that the time “12:00” includes crashes that were automatically deferred to noon by the NTI system for those incidents when no actual crash time was entered. Therefore it would be best to disregard the crash types for noon, as most of these crashes could have actually occurred at some other time of the day. On the basis of the more accurate information contained in the Australian Truck Crash Database 2000, noon crash totals for fatal and serious injury crashes lie about halfway between those for 11am and 1pm.

3.4.1 Rear end or failure to give way collisions

Figure 9 indicates that the majority of rear end collisions or failure to give way incidents constituted claims of less than \$10 000 (82 per cent) and occurred between 6am-6pm (83 per cent). The category ‘Hit in rear by third party’ was very small, however half of these crashes between mid-morning and late afternoon were *major* crashes, that is, they resulted in claims of \$10 000 or more.

FIGURE 9.
NTI truck crashes resulting from rear end collisions or failure to give way incidents by time of day, 500-1499 kilometres outward distance from base, 1998 to 2002



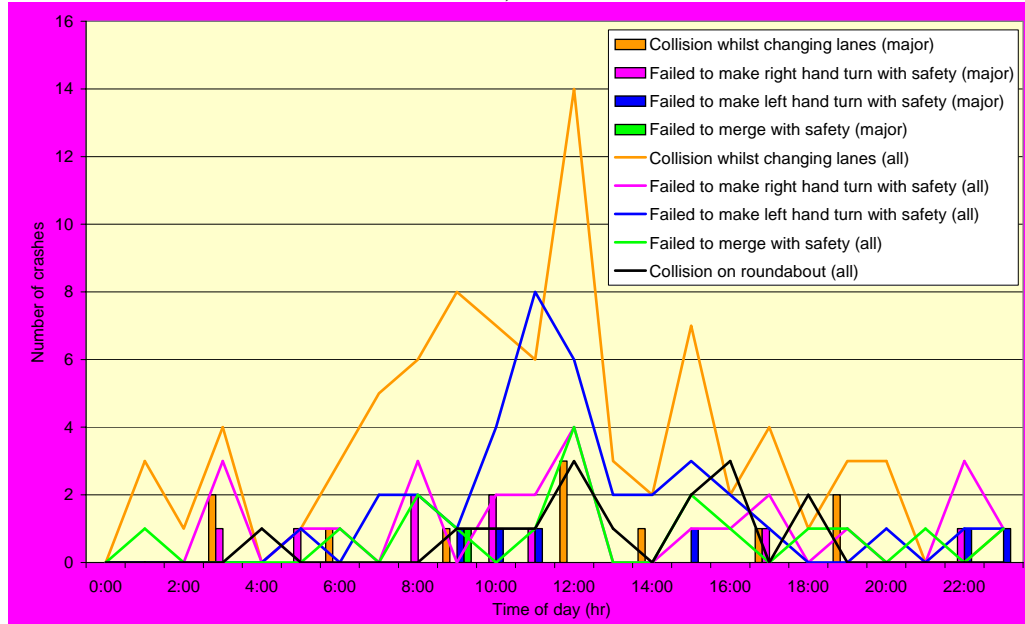
A little over half of *all* crashes in this grouping of four categories were in the ‘Hit third party in rear’ category, although only 20 per cent of these resulted in a *major* crash.

The second most common category in this grouping, ‘Third party failed to give way’, accounted for 29 per cent of the crashes, with 29 per cent of these being categorised as *major* crashes.

3.4.2 Turning, merging and lane changing collisions

Figure 10 indicates that the majority of turning, merging and lane changing incidents constituted claims of less than \$10 000 (87 per cent) and occurred between 6am-6pm (77 per cent). None of the ‘Collision on roundabout’ incidents resulted in claims of \$10 000 or more.

FIGURE 10.
NTI truck crashes resulting from turning, merging and lane changing incidents by time of day, 500-1499 kilometres outward distance from base, 1998 to 2002



Close to half of *all* crashes in this grouping of five categories were in the ‘Collision whilst changing lanes’ category, and only 13 per cent of these resulted in a *major* crash.

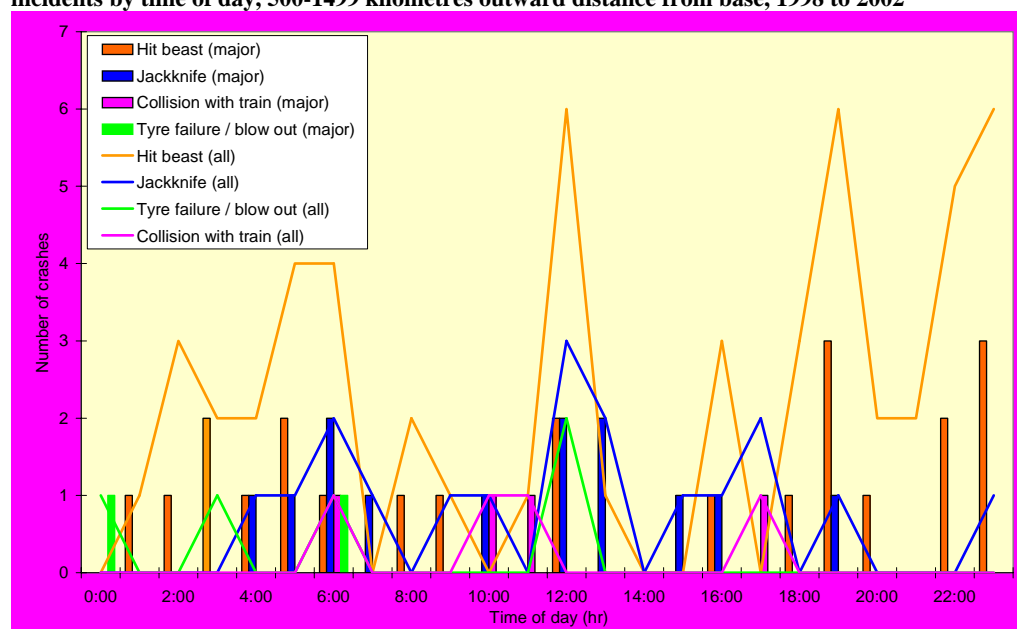
The second most common category in this grouping, ‘Failed to make left hand turn with safety’, accounted for 21 per cent of the crashes, with 16 per cent of these being categorised as *major* crashes.

The third most common category in this grouping, ‘Failed to make right hand turn with safety’, accounted for 14 per cent of these crashes, of which 36 per cent were *major* crashes. This shows that while left hand turning crashes were slightly more numerous, right hand turning crashes were more severe.

3.4.3 Collisions with animals or trains, jackknife or tyre failure incidents

Figure 11 indicates that of the collisions with animals or trains, jackknife or tyre failure incidents, approximately half (52 per cent) resulted in claims of \$10 000 or more, and approximately half (52 per cent) occurred overnight between 6pm-6am. The four 'Collision with train' crashes all resulted in claims greater than \$10 000.

FIGURE 11.
NTI truck crashes resulting from collisions with animals or trains, jackknife or tyre failure incidents by time of day, 500-1499 kilometres outward distance from base, 1998 to 2002



About two-thirds of *all* crashes in this grouping of five categories were in the 'Hit beast' category, and 43 per cent of these resulted in a *major* crash.

The second most common category in this grouping, 'Jackknife', accounted for 22 per cent of the crashes, with 72 per cent of these being categorised as *major* crashes.

3.4.4 'Hit beast' crashes

'Hit beast' crashes accounted for 7 per cent of both *major* and *all* crashes in the 500-1499 kilometre outward distance from base range (figures 6 & 7). Included in 'Hit beast' crashes are incidents involving evasive action taken to miss an animal that had wandered onto the road. Nineteen per cent of *all* 'Hit beast' crashes were as a result of a truck driver attempting to avoid hitting an animal, and this proportion rose to 30 per cent for *major* crashes. At least half the time it was cattle that a driver was attempting to avoid. The evasive action tended to result in the truck either running off the road or rolling.

TABLE 4.
NTI crashes involving hitting beasts, 500-1499 kilometres outward distance from base, 1998 to 2002

	Kangaroo	Cattle	Emu	Unidentified animal
ALL CRASHES	26	21	2	5
Proportion of total beast crashes	48%	39%	4%	9%
MAJOR CRASHES	7	13	0	3
Proportion of major beast crashes	30%	57%	0%	13%

In most 'Hit beast' crashes, the animal involved was noted. As indicated in table 4, kangaroos were involved in nearly half of *all* 'Hit beast' crashes (48 per cent) but in only 30 per cent of *major* crashes. Cattle, on the other hand, were involved in 39 per cent of *all* 'Hit beast' crashes and in 57 per cent of *major* crashes. That is, while crashes with kangaroos were more numerous, crashes with cattle sustained greater damage.

Table 5 looks at the time sectors in which 'hit beast' crashes occurred. The crashes that occurred exactly at noon have been singled out as, due to the NTI system automatically inserting a crash time of noon when no actual crash time was entered, most of these crashes probably occurred at some other time. Therefore, noon-6pm covers the period 12:01-17:59, while 6pm-midnight covers 18:00-23:59, etc.

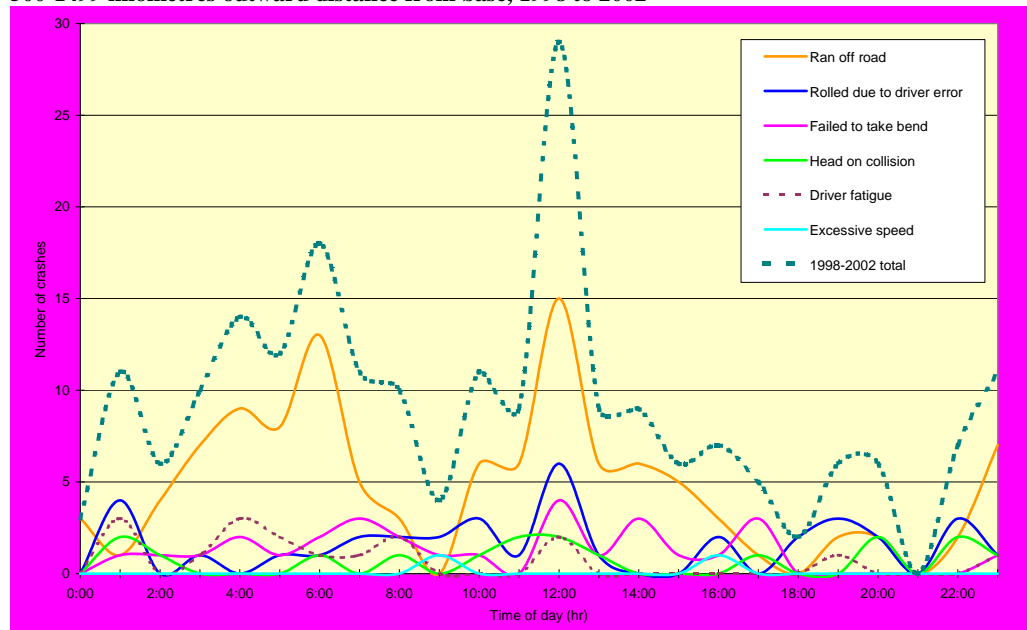
TABLE 5.
NTI crashes involving hitting beasts, by time sector, 500-1499 kilometres outward distance from base, 1998 to 2002

	Kangaroo	Cattle	Emu	Unidentified animal
ALL CRASHES				
Noon	5	1	-	-
Noon-6pm	1	-	2	1
6pm-midnight	9	12	-	3
Midnight-6am	7	5	-	-
6am-noon	4	3	-	1
MAJOR CRASHES				
Noon	2	-	-	-
Noon-6pm	-	-	-	1
6pm-midnight	2	7	-	1
Midnight-6am	2	5	-	-
6am-noon	1	1	-	1

Not unexpectedly, the majority of 'Hit beast' crashes occurred overnight. Two-thirds of *all* 'Hit beast' crashes occurred between 6pm-6am, while for *major* crashes the proportion was closer to three-quarters. The greater proportion of both *major* and *all* crashes occurred in the 6pm-midnight time sector.

3.4.5 Crashes resulting from possible fatigue-or-speed related incidents

FIGURE 12.
NTI all truck crashes resulting from possible fatigue-or-speed related incidents by time of day, 500-1499 kilometres outward distance from base, 1998 to 2002



The possible fatigue-or-speed related group takes into account the following incidents:

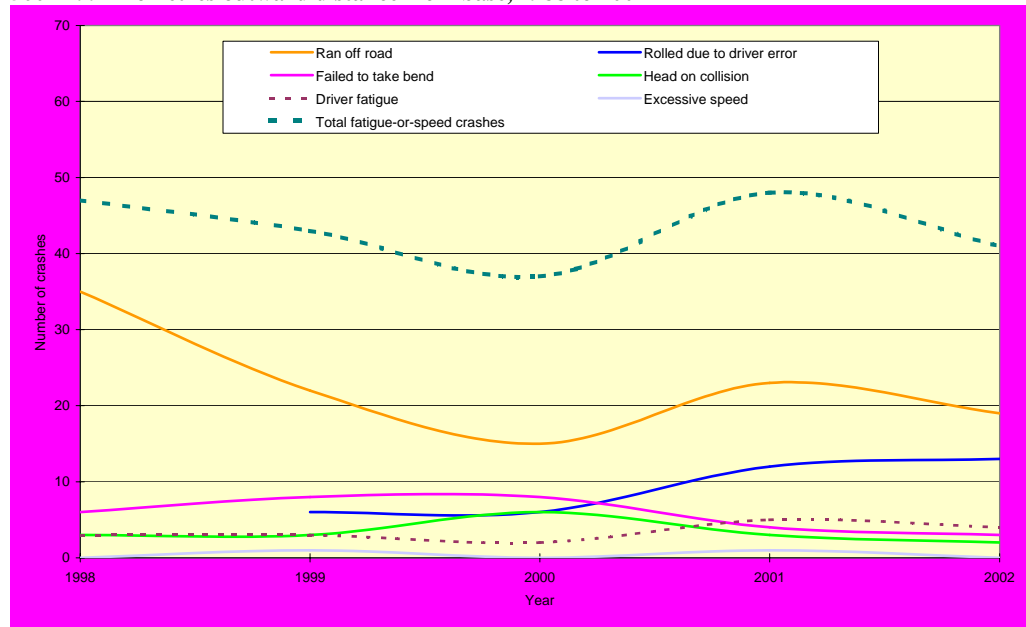
- 'Ran off road',
- 'Rolled due to driver error',
- 'Failed to take bend',
- 'Head on collision',
- 'Driver fatigue', and
- 'Excessive speed'.

Figure 12 focuses on *all* crashes in the possible fatigue-or-speed related categories as over three-quarters (77 per cent) of the crashes in this grouping resulted in claims of \$10 000 or more. Nearly 60 per cent of *all* crashes in the possible fatigue-or-speed related grouping occurred between 6am-6pm, and over half (53 per cent) of these were in the 'Ran off road' category.

Disregarding the false peak at noon, the most critical stretch of time for possible fatigue-or-speed crashes would appear to be between 3am-8am.

Figure 13 looks at *all* possible fatigue-or-speed related crashes on a year-by-year basis between 1998 and 2002. The category 'Rolled due to driver error' appears to have been created only in the late 1990s. Prior to this, most of the 'Rolled due to driver error' crashes were in all likelihood categorised as 'Ran off road'.

FIGURE 13.
NTI all truck crashes resulting from possible fatigue-or-speed related incidents, by year,
500-1499 kilometres outward distance from base, 1988 to 2002

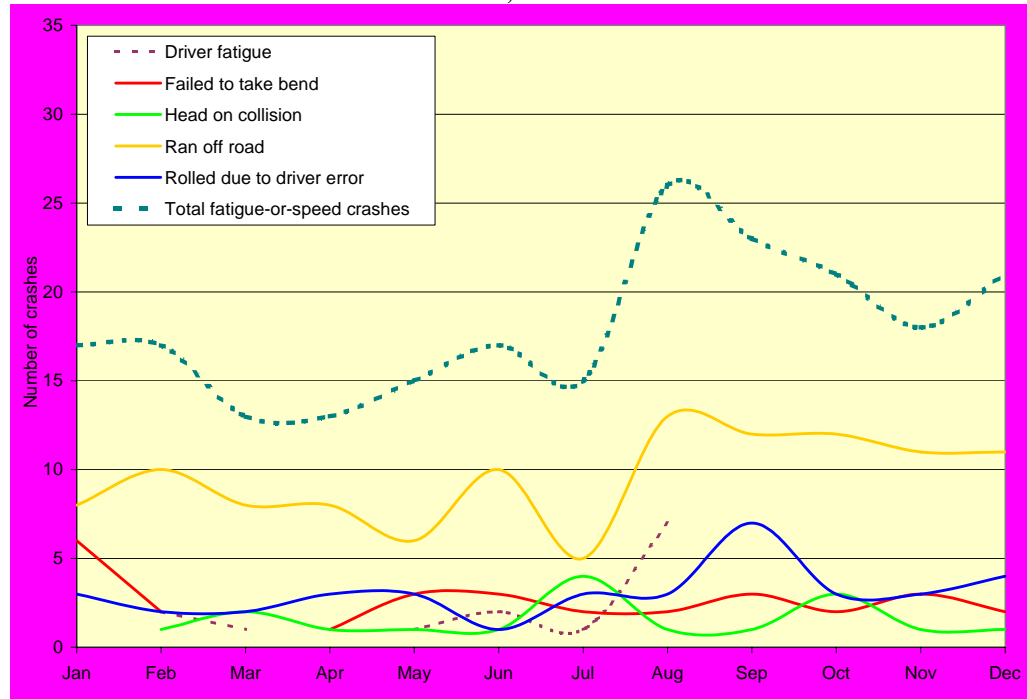


The gradual decline in total possible fatigue-or-speed crashes since 1998 had a significant reversal in 2001, before declining again in 2002. It is interesting to note that while the number of *all* crashes in the 500-1499 kilometres outward distance range decreased substantially in 2001 (table 1), the possible fatigue-or-speed related crashes peaked in that year (figure 13). That is, the possible fatigue-or-speed related crashes, on average, slightly increased their previous level of crashes in 2001 while other crash types reduced in volume. In fact, compared to the 1998-2002 overall annual average, in 2001 there was an approximate halving of incidents in the following crash types: 'Changing lanes collision', 'Hit beast', 'Hit in rear by third party', 'Merged without safety', 'Roundabout collision', 'Third party failed to give way' and 'Insured failed to give way'.

'Failed to take bend' and 'Head on collisions' did not follow the overall trend in so far as they rose slightly during 1999 and 2000, then fell during 2001 and 2002.

Looking at possible fatigue-or-speed related crashes in the 500-1499 kilometres outward distance from base range on a month-by-month basis, more crashes occurred in the second half of the year, with a peak recorded for August (figure 14).

FIGURE 14.
NTI all truck crashes resulting from possible fatigue-or-speed related incidents, by month, 500-1499 kilometres outward distance from base, 1998 to 2002

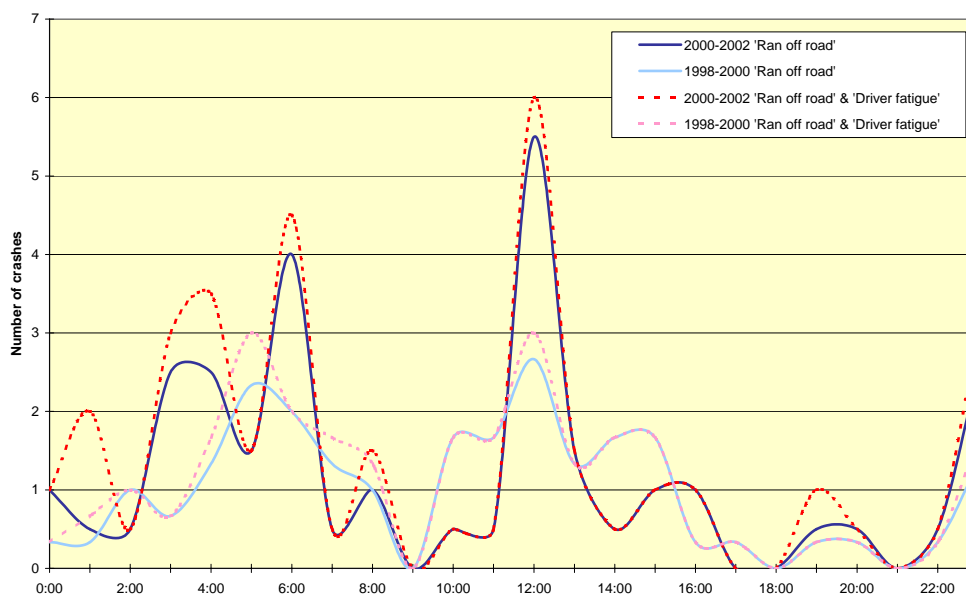


The 'Driver fatigue' crashes recorded in figure 14 appear to follow the trend of the 'Ran off road' crashes. The two *non-major* 'Excessive speed' crashes do not show up on the graph; however, one occurred in May and the other in October.

3.4.6 'Ran off road' and 'Driver fatigue' crashes

Discounting at least half the noon 'Ran off road' crashes as incorrectly timed (because the NTI system defaults to noon those crashes for which a time is not recorded), approximately 50 per cent of 'Ran off road' crashes occurred in the third of the day between 1am-9am. About 80 per cent of the 'Driver fatigue' incidents occurred over the same third of the day. As can be seen in figure 15, the period between 3am-6am (ie. 3:00-6:59am) is a particularly critical time period for 'Ran off road' and 'Driver fatigue' incidents.

FIGURE 15.
NTI 'Ran off road' and 'Driver fatigue' all truck crashes, annual averages, by time of day, 500-1499 kilometres outward distance from base, 1998 to 2002

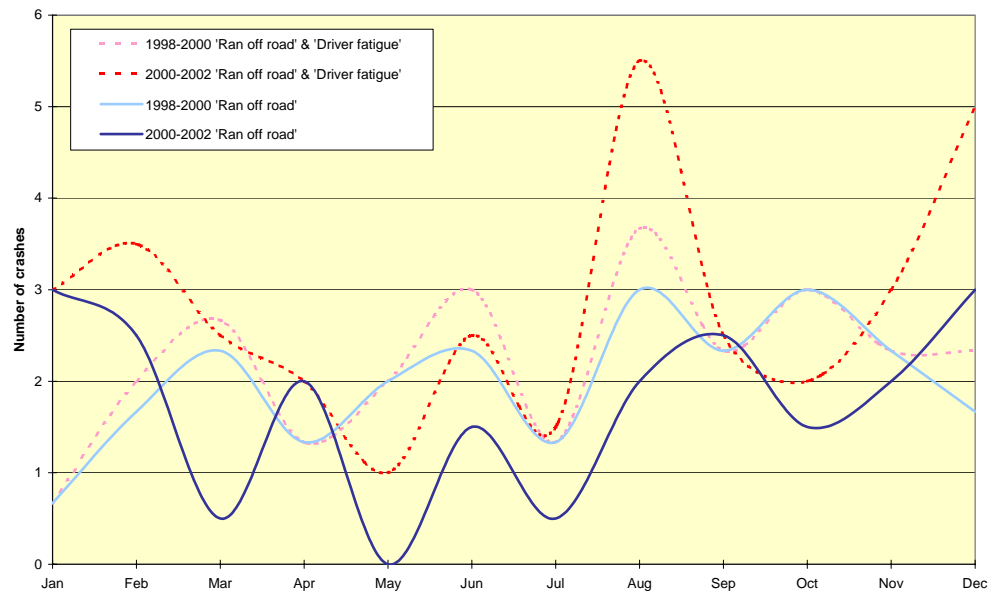


Differences between the dark and pale sets of coloured lines in figure 15 indicate the differences between the annual average 1998-2002 'Ran off road' / 'Driver fatigue' crashes (pale lines) and the annual average recorded for 2001-2002 (dark lines). The differences between the dark and pale lines highlights the changing trends in more recent years. The differences between the red and the blue tones within the same average annual spans indicates the crashes attributed to driver fatigue.

Figure 15 shows that during 2001-2002 there were annual average increases of 'Ran off road' incidents at 3-4am, 6am, and 11pm, and decreases at 7am, 10-11am and 2pm. Over the same period, annual average 'Driver fatigue' incidents increased between 11pm-1am, and 3-4am.

Figure 16 shows that about half the 'ran off road' and more than a half (about 60 per cent) of the 'driver fatigue' crashes occurred in the five months between August and December. The fewest number of 'ran off road' crashes occurred in May and July. Compared to 1998-2002, in 2000-2002 there was reduction in these categories of crashes during October, but a rise during December, indicating a slight change in the monthly trend in more recent years.

FIGURE 16.
NTI 'Ran off road' and 'Driver fatigue' all truck crashes, annual averages, by month, 500-1499 kilometres outward distance from base, 1998 to 2002



Differences between the dark and pale sets of coloured lines in figure 16 indicate the differences between the annual average 1998-2002 'Ran off road' / 'Driver fatigue' crashes per month and the annual average recorded for 2001-2002.

Figure 16 shows that during 2001-2002 there were annual average increases in 'Ran off road' incidents in December-February, and decreases in most other months. Over the same period, annual average increases in 'Driver fatigue' incidents occurred during February, August and December, and decreases in May and June.

3.5 CRASHES BY FREIGHT TASK AND TIME SECTOR

Approximately two-thirds of NTI heavy truck road crash claims involved general carriers. Nearly half the remainder of the crash claims involved refrigerated carriers. However, without information on the underlying number of trucks involved in the specific freight categories, it is not possible to say whether any particular category is over-represented in crashes. Claims frequency analysis carried out by NTI itself indicated that during 2001 furniture carriers were at the higher end of the scale and livestock carriers were at the lower end. However, there was not a very wide margin of difference in crash representations across the full range of carriers.

Many of the building industry claims were deleted from the database as they appeared to be on-site crashes rather than ones that occurred on public roads. The bulk of those that remained occurred at less than 500 kilometres outward distance from base.

As indicated previously, midnight-6am covers the time period 0:00 to 5.59, 6am-noon covers 6:00 to 11.59, etc.

Table 6 and figure 17 show that the highest proportion of *major* truck crashes for most of the individual freight task categories occurred between 6am-noon. The only notable exception was 'Vehicle carriers' which registered its peak between noon-6pm. However, as the underlying

'Vehicle carrier' crash numbers were low, the peak in afternoon crashes is not significant. 'General carriers' also showed a slight rise in the afternoon, although, as a handful of the noon crashes would have resulted from crashes that had defaulted to noon (in the absence of a crash time being entered), it is likely that 'General carrier' *major* crashes were evenly distributed between the morning and afternoon sectors.

TABLE 6.
NTI major crashes by freight task and time sector, 500-1499 kilometres outward distance from base, 1998 to 2002

	Midnight-6am	6am-noon	Noon-6pm	6pm-midnight
General carrier	46	59	62	35
Refrigerated carrier	11	18	14	6
Livestock carrier	2	7	5	3
Tipping	3	7	3	3
Vehicle carrier	3	2	4	2
Furniture removalist	1	5	1	2
Hazardous goods - bulk	1	3	1	1
Building industry	0	1	0	0

FIGURE 17.
Proportion of NTI major truck crashes by freight task and time sector, 500-1499 kilometres outward distance from base, 1998 to 2002

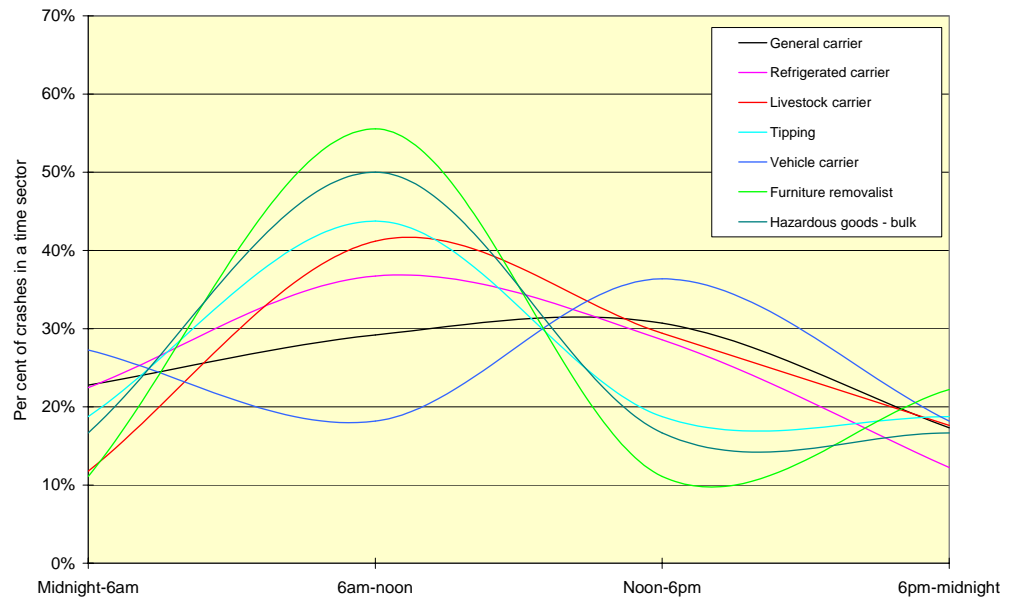
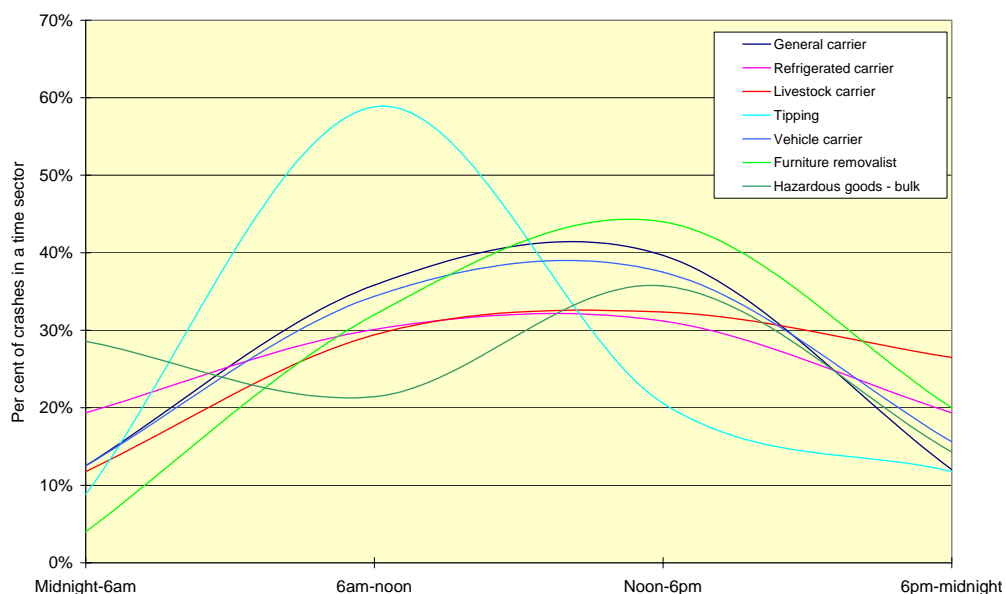


Table 7 and figure 18 show that the highest proportion of *all* truck crashes for most of the individual freight task categories occurred between noon-6am. The only exception was 'Tipping', which registered a noticeable peak between 6am-noon. Since a handful of the noon crashes would have resulted from crashes that had defaulted to noon (in the absence of a crash time being entered), it is likely that the rise of *all* crashes in the noon-6pm sector was even flatter for most freight task categories. That is, crashes in the morning and afternoon sectors were probably fairly evenly distributed.

TABLE 7.
NTI all crashes by freight task and time sector, 500-1499 kilometres outward distance from base, 1998 to 2002

	Midnight-6am	6am-noon	Noon-6pm	6pm-midnight
General carrier	72	206	228	69
Refrigerated carrier	18	28	29	18
Livestock carrier	4	10	11	9
Tipping	3	20	7	4
Vehicle carrier	4	11	12	5
Furniture removalist	1	8	11	5
Hazardous goods - bulk	4	3	5	2
Building industry	0	4	3	0

FIGURE 18.
Proportion of NTI all truck crashes by freight task and time sector, 500-1499 kilometres outward distance from base, 1998 to 2002

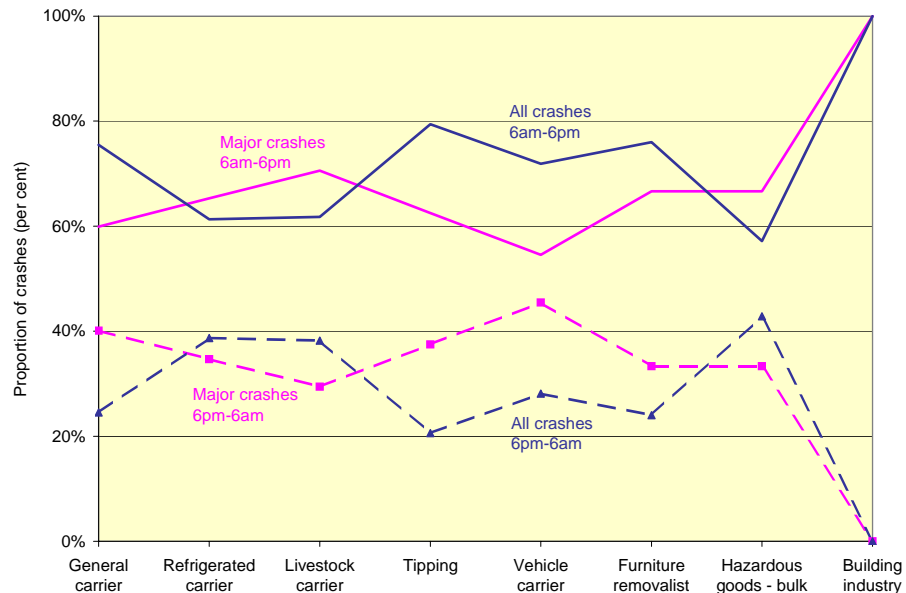


A comparison of figures 17 and 18 indicates that while there was a preponderance of *major* crashes in the morning sector, there was a higher proportion of *non-major* crashes in the afternoon sector. In fact, 33 per cent of *major* crashes and 36 per cent of *all* crashes occurred between 6am-noon, while 29 per cent of *major* crashes and 38 per cent of *all* crashes occurred between noon-6pm.

The proportion of *major* crashes between 6pm-6am (ie. overnight) was 39 per cent, while for *all* crashes it was 27 per cent. This points towards an increase in incidents of greater severity occurring in overnight crashes.

Figure 19 shows the distribution of day (6am-6pm) and night (6pm-6am) crashes by freight task categories. On average, 64 per cent of overall *major* crashes occurred during the day, compared with 69 per cent of *all* crashes.

FIGURE 19.
Proportion of NTI truck crashes by freight task during day and night sectors, 500-1499 kilometres outward distance from base, 1998 to 2002



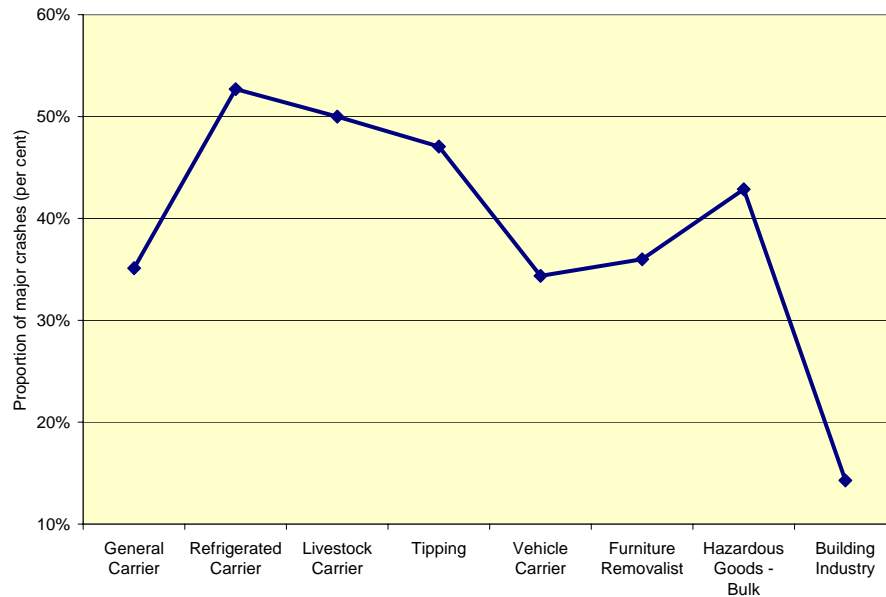
The sole 'Building industry' *major* crash occurred during the day. The majority (55-70 per cent) of *major* truck crashes in the other freight task categories also occurred between 6am-6pm. 'Livestock carrier' *major* crashes had an above average proportion of crashes during the day, while 'Vehicle carrier' *major* crashes had an above average proportion during the night.

Looking at *all* truck crashes, the handful in the 'Building industry' again, as would be expected, all occurred during the day, and 60-80 per cent of the crashes in the other freight task categories occurred during the day (figure 19). 'Tipping' and 'Furniture removalist' *all* crashes had an above average proportion of crashes during the day, while 'Refrigerated carrier', 'Livestock carrier' and 'Hazardous goods – bulk' had an above average proportion during the night.

3.5.1 Proportion of major crashes by freight task

As can be seen in figure 20, half the 'Livestock carrier' crashes, and slightly more than half the 'Refrigerated carrier' crashes, in the 500-1499 kilometres outward distance from base range, resulted in *major* crashes. *Major* crashes are more likely to have incurred a fatality or serious injury than *non-major* crashes.

FIGURE 20.
Proportion of NTI major truck crashes by freight task, 500-1499 kilometres outward distance from base, 1998 to 2002



3.6 CRASHES BY FREIGHT TASK, CRASH TYPE AND TIME OF DAY

The following two tables (tables 8 and 9) show the crash type and time of day for the two most common freight task crashes in the 500-1499 kilometre outward distance from base. The 'General carrier' category covered 71 per cent of *all* freight task crashes, while the next most common category, 'Refrigerated carrier' amounted to 11 per cent.

3.6.1 'General carrier' all crashes

A number of the incidents in the database contain some information on the circumstances of the crash. For instance, in crashes involving 'General carrier' trucks (table 8):

- 'Collision whilst changing lanes' incidents were the fault of a third party in one-third of the cases;
- 'Left hand turn without safety' incidents were mostly the fault of the truck;
- 'Right hand turn without safety' incidents were the fault of a third party in almost one-third of cases;
- Half the 'Failed to merge with safety' incidents were the fault of a third party;
- Nearly half the 'Failed to take bend' incidents resulted in a truck roll-over, while the rest either ran off the road, hit a structure or a third party vehicle, or damaged a trailer;
- Ninety-two per cent of 'Head on collision' incidents were the fault of a third party;
- Sixteen per cent of 'Ran off road' incidents involved swerving to miss a third party or being blinded by oncoming headlights, 4 per cent (all between 1:00am-5:00am) involved bending down for drinks or smokes, and 3 per cent involved a steering mechanism fault. About three-quarters of the incidents had no details on circumstances;
- Sixteen per cent of 'Rolled due to driver error' incidents occurred on a bend or roundabout, 10 per cent involved a mechanical problem, and about 25 per cent of the incidents included circumstances like a swarm of bees flying into the cabin, blinded by the late afternoon sun, a bump in the road, a wet road, or a trailer catching on the edge of the road; and

TABLE 8.
NTI all general carrier crashes by crash type and time of day, 500-1499 kilometres outward distance from base, 1998 to 2002

	Time of day																							
	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
Collision on roundabout	-	-	-	-	1	-	-	-	-	1	-	1	1	1	-	1	3	-	2	-	-	-	-	-
Collision whilst changing lanes	-	2	1	1	-	1	3	3	3	7	6	5	13	3	2	5	1	4	1	1	1	-	-	-
Collision with train	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
Driver fatigue	-	1	-	-	2	2	1	1	1	-	-	-	2	-	-	-	-	-	-	1	-	-	-	1
Excessive speed	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Left hand turn without safety	-	-	-	-	-	-	2	2	1	2	7	6	2	1	3	1	1	-	-	1	-	1	1	1
Right hand turn without safety	-	-	-	2	-	1	1	-	3	-	-	2	4	-	-	1	-	2	-	-	-	-	1	1
Failed to merge with safety	-	1	-	-	-	-	1	-	2	1	-	1	3	-	-	1	-	-	1	-	-	-	-	1
Failed to take bend	-	1	-	1	2	1	1	3	1	-	-	-	2	1	2	1	-	2	-	-	-	-	-	1
Head on collision	-	1	1	-	-	-	1	-	1	-	-	-	2	1	-	-	-	1	-	-	1	-	2	1
Hit beast	-	1	2	2	2	1	3	-	1	-	-	1	5	1	-	-	3	-	1	5	1	2	1	3
Hit in rear by third party	-	-	-	-	1	-	-	2	-	-	1	2	-	-	1	1	1	-	-	-	-	-	-	-
Hit third party in rear	1	1	-	-	-	1	4	4	18	8	12	12	17	10	9	12	6	8	5	2	2	1	1	-
Insured failed to give way	-	-	-	2	-	-	2	2	3	5	3	1	12	-	1	1	1	3	-	2	-	-	-	-
Jackknife	-	-	-	-	1	-	2	-	-	1	1	-	3	2	-	-	1	2	-	1	-	-	-	1
Ran off road	2	1	3	5	8	6	7	3	2	-	3	4	10	5	6	3	-	-	-	2	2	-	2	2
Rolled due to driver error	-	3	-	-	-	1	1	-	-	2	2	1	2	-	-	-	1	0	1	2	2	-	1	-
Third party failed to give way	-	-	1	2	-	1	1	5	4	6	5	6	12	1	2	5	3	2	1	-	1	2	2	2
Tyre failure / blow out	1	-	-	1	-	-	1	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-

Note: The NTI system defaults to noon all crashes where a specific crash time was not entered.

- Nearly 60 per cent of ‘Driver fatigue’ incidents occurred between 6pm-6am. Disregarding the two crashes at noon because the NTI system allocates a crash to noon when no particular time was recorded, 70 per cent of the ‘Driver fatigue’ incidents occurred between 4am-8am. Assuming an average speed of 83 kilometres per hour, three of the trucks began their trip between midnight-2am, two started 7am-8am, three started 3pm-4pm, three started 7pm-8pm, and we will disregard the crash at noon. From the above, 82 per cent of ‘General carrier’ crashes due to driver fatigue appear to have occurred when the truck began its trip between 3pm-2am. This points to the possibility that some truck drivers may not have been sufficiently refreshed when they began driving between mid-afternoon and the very early hours of the morning.

3.6.2 ‘Refrigerated carrier’ all crashes

A more in-depth look at some ‘Refrigerated carrier’ incidents (table 9) reveals that:

- ‘Hit third party in rear’ incidents were the most common category of crash types and accounted for 20 per cent of the crashes;
- ‘Ran off road’ incidents were the second most common category, with 13 per cent resulting from the truck being forced off the road by a third party vehicle; and
- Of the three ‘Driver fatigue’ incidents, one was the result of fatigue by a third party vehicle. In the two incidents where the truck driver was considered to be suffering from fatigue, the trucks had probably begun their trips at about 3pm and 7pm. In the third incident, where the third party vehicle was at fault, the truck driver probably began the trip close to midnight.

TABLE 9.
NTI all refrigerated carrier crashes by crash type and time of day, 500-1499 kilometres outward distance from base, 1998 to 2002

	Time of day																							
	0:00	1:00	2:00	3:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00		
Collision whilst changing lanes	-	1	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	
Collision with train	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Driver fatigue	-	1	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Left hand turn without safety	-	-	-	-	1	-	-	-	-	2	1	-	-	-	-	-	-	-	-	-	-	-	-	
Right hand turn without safety	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-	-	1	-	-	
Failed to merge with safety	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	
Failed to take bend	-	-	1	-	-	-	-	1	-	1	-	2	1	-	-	-	-	-	-	-	-	-	-	
Head on collision	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	
Hit beast	-	-	-	-	2	-	-	1	-	-	-	1	-	-	-	-	1	-	1	-	1	-	1	
Hit in rear by third party	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Hit third party in rear	1	-	1	-	1	1	1	1	-	-	3	6	-	-	-	1	-	1	1	-	-	-	1	
Insured failed to give way	-	-	-	-	-	1	-	-	-	-	1	2	-	-	-	-	-	-	-	1	-	-	-	
Jackknife	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Ran off road	-	-	-	1	1	2	1	1	-	-	-	3	-	1	2	1	-	-	-	-	-	-	2	
Rolled due to driver error	-	1	-	1	-	-	-	1	-	-	-	3	-	-	1	-	1	-	-	-	-	1	1	
Third party failed to give way	-	-	-	-	1	1	2	1	-	-	-	3	-	1	-	-	-	-	-	-	-	-	1	

Note: The NTI system defaults to noon those crashes where a specific crash time was not entered.

3.6.3 'Driver fatigue' crashes

Table 10 focuses on those crashes that appeared to be most likely a result of driver fatigue. Disregarding the sole noon crash, 56 per cent of the crashes occurred between 1am-6am; while 69 per cent occurred between 6pm-6am.

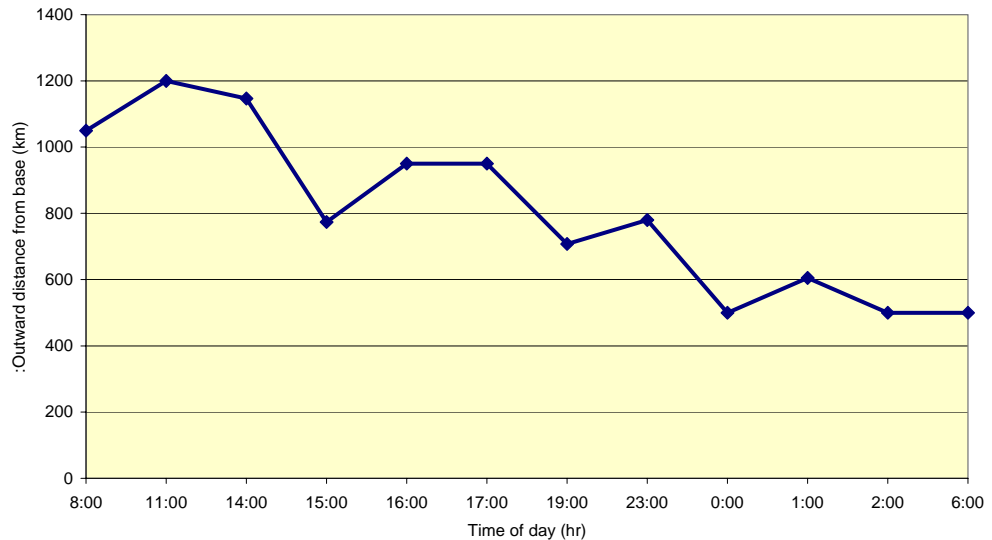
The number of 'Driver fatigue' crashes in 2001 and 2002 was higher than the annual average over the five years 1998 to 2002. Over 40 per cent of the crashes occurred during August – more than twice as many as in the next most common month for 'Driver fatigue' crashes.

TABLE 10.
NTI all crashes by 'Driver fatigue' crash type, 500-1499 kilometres outward distance from base, 1998 to 2002

Time of day (hr)	Month	Year	Outward distance from base (km)	Freight task	Circumstances
1:00	Dec	2000	520	General carrier	Single vehicle accident, ran off road and hit tree
1:00	Jul	2002	848	Refrigerated carrier	Lapse of concentration, collided with oncoming third party
1:30	Aug	2001	1200	Tipping	Driver fell asleep and rolled trailers
3:30	Dec	2001	703	Refrigerated carrier	Ran off road, possibly fell asleep
4:00	Dec	1999	700	General carrier	Driver went to sleep and unit left road
4:15	Aug	2002	1147	General carrier	Driver lost concentration and rolled vehicle
4:30	Aug	2001	950	Livestock carrier	Driver fell asleep at wheel and unit fell over
5:30	Jun	1998	500	General carrier	Driver went dizzy and ran off road
5:50	Aug	1999	900	General carrier	Driver fell asleep and lost control
6:30	May	2001	1200	General carrier	Driver lost concentration and hit third party
7:30	Aug	1998	500	General carrier	Driver fell asleep, causing all units to roll
8:00	Feb	2001	605	General carrier	Driver fell asleep and ran off road
8:35	Feb	1999	780	Refrigerated carrier	Third party hit truck while coming round corner
12:00	Aug	2002	1448	General carrier	Driver blacked out, no recollection of accident
12:30	Jun	1998	500	General carrier	no information
19:50	Aug	2002	1050	General carrier	Driver fell asleep and hit another road train
23:00	Mar	2000	700	General carrier	Driver dropped off to sleep and unit left road

Figure 21 looks at possible trip start times for *all* 'Driver fatigue' crashes with the exclusion of the noon crash. An average speed of 83 kilometres per hour was used to calculate backwards from the time of the crash to arrive at a trip start time. If the average speed had been faster than this, then the start time for any of the trips would have been a little later than indicated on figure 21.

FIGURE 21.
NTI 'Driver fatigue' all crashes by estimated start time of trip, 500-1499 kilometres outward distance from base, 1998 to 2002



Note: The outward distance travelled has been averaged for the estimated start time of the two crashes at 15:00, the two crashes at 16:00, and the three crashes at 19:00 .

Beginning at 8am – which could be perceived as being a reasonable start time for a 'normal' work day which had allowed a full night's sleep beforehand – we see that for 'Driver fatigue' crashes, as the start time progresses after mid-afternoon, the distance travelled before crashing generally decreases.

Therefore, it would appear that in truck crashes where driver fatigue might be implicated, the later in the day that the trip began, the shorter was the distance covered prior to the crash.

4 CONCLUSIONS

The National Transport Insurance 1998-2002 data indicate that while most heavy truck crashes occurred within 500 kilometres of base, about 10 per cent occurred in the 500-1499 kilometres from base range, of which three-quarters were on an outward leg of the trip. Thirty-eight per cent of these outward bound truck crashes resulted in a minimum claim of \$10 000 and were designated as *major* crashes by ATSB for the purposes of this study.

Peaks in *major* crashes occurred at 900-999 and 1100-1199 kilometres outward distance from base, which was estimated to be approximately 11 and 13 hours into the trip. For *all* crashes the peaks occurred at 900-999 and 1200-1299 kilometres, which was estimated to be approximately 11 and 14 hours into the trip.

Seventy per cent, of *all* crashes at outward distances of 500-1499 kilometres occurred during the day, with the proportion reducing to 60 per cent for *major* crashes. Furthermore, the majority of these daytime crashes occurred between 6am-noon. In the most recent two years of the data set, the hours between 5am-7am appear to have been a particularly critical time for *major* truck crashes, although there was also a noticeable peak at 10am in 2002 and at 7pm in 2001.

For *major* crashes, the dominant crash type was 'Ran off road' (28 per cent), followed by 'Hit third party in rear' (12 per cent). The two dominant crash types were reversed when taking into account *all* crashes, with 'Hit third party in rear' being the most predominant (22 per cent), followed by 'Ran off road' (14 per cent). The group of crash types gathered together to loosely form the possible fatigue-or-speed related crashes ('Ran off road', 'Failed to take bend', 'Rolled due to driver error', 'Driver fatigue', 'Head on collision' and 'Excessive speed') accounted for 52 per cent of *major* crashes and 27 per cent of *all* crashes.

Over three-quarters of rear end and failure to give way collisions, and turning, merging and lane changing incidents occurred during the day, and the majority were *not major* crashes. On the other hand, about half the collisions with animals or trains, or jackknife or tyre failure incidents resulted in *major* crashes. Most of the crashes involving animals occurred overnight, particularly between 6pm-midnight, and collisions with cattle were more likely to result in *major* crashes.

Over three-quarters of *all* possible fatigue-or-speed related crashes were categorised as *major*. Nearly 60 per cent occurred during the day between 6am-6pm, and over half of these crashes were 'Ran off road' crash type. The most critical time for possible fatigue-or-speed crashes appeared to be between 3am-8am. While the number of *all* crashes in the 500-1499 kilometres outward distance range decreased substantially in 2001, the possible fatigue-or-speed related crashes peaked in that year. That is, possible fatigue-or-speed related crashes, on average, slightly increased in 2001 while other crash types reduced in volume. Possible fatigue-or-speed related crashes were more predominant during the months of August to December with a noticeable peak in August.

The majority of *all* crashes for the individual freight carrier categories occurred between noon-6pm, the only notable exception being 'Tipping' crashes which occurred predominantly between 6am-noon. However, the majority of *major* crashes for most of the different freight carrier categories occurred in the 6am-noon sector. This could be an indication of greater pressures on road users resulting in higher risk-taking behaviour in the mornings compared with minor lapses in judgement or concentration in the afternoons.

It seems reasonable to assume that trucks involved in crashes in the 500-1499 kilometres outward distance from base were, on the whole, involved in long-distance transport. The

foregoing statistics have shown that crashes are spread fairly evenly round the clock, taking into account that higher traffic densities during the day will inevitably result in a higher number of crashes during the day. The possible fatigue-related crashes indicate that truck drivers probably need to summon more attention in the pre-dawn and early morning hours, and to be fully rested when embarking on trips in the afternoon or evening. The data show that truck drivers are not responsible for all the crashes they are involved in; in fact, on the basis of Australian Transport Safety Bureau fatal crash data the drivers of heavy trucks were assessed as being at fault in only about a quarter of fatal crashes. On the other hand, truck drivers may need to exercise even greater care in avoiding collisions with other, less professional, less experienced road users.