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St John's Ambulance Service, Southern Region: Control Centre Dispatch Profile (1997-2001)

presented to the Chief Executive, St John's Ambulance Service, Southern Region, NZ

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Executive Summary

The St John's Ambulance Service, Southern Region Control Centre (the control centre) is located in Dunedin City and controls 56 ambulances based in 26 regional stations. The Southern Region covers an area of approximately 54,000 square kilometres, which has a usually resident population of 272,541 (Census, 2001). This report focuses on the dispatch and workload profile of the control centre between the 1st January 1997 and the 31st December 2001. During this period the control centre dispatched ambulances on approximately 135,822 occasions to a total of 118,759 incidents (this includes both emergency incidents and patient transfers). Based on an analysis of these incidents several key findings are discussed in this report. These include:

- A 21.8% increase in the total number of incidents handled in the control centre between 1997 and 2001
- A 44 second increase in average activation times between 1997 and 2001
- A strong correlation between increased workload and increased activation times
- A large increase in activation times during low and medium workload periods

Table of Contents

Table of Figures

1 Introduction

1.1 Overview

This report aims to formulate a dispatch profile for the St John's Ambulance Service, Southern Region Control Centre (the control centre) between 1st January 1997 and 31st December 2001. The report is based on the analysis of end of day reports generated by St John's Ambulance between the dates mentioned above.

The end of day reports outline every incident that the control centre handled on a particular day. Included in each incident outline is the time the emergency call was received, the location of the incident, the ambulance that was dispatched, the time the ambulance was dispatched, and the time the ambulance arrived at the location. It is these details that are used to formulate a dispatch profile for the control centre.

Also incorporated into the profile (Section 2) is an analysis of the changing workload faced by dispatchers in the control centre. The workload analysis focuses on areas such as the number of calls received each year, the breakdown of emergency incidents and patient transfers, the number of multiple response jobs compared to single response jobs, and the distribution of rural and urban incidents.

Following the workload analysis Section 3 provides an in-depth look at the changes in average performance times for several of the initial phases in the incident life cycle. These include activation times, response times and on location times. Section 4 compares activation times for multiple response and single response incidents whilst Section 5 presents the activation times for urban and rural incidents. Section 6 examines the influence that workload had on activation times for emergency incidents and introduces readers to the leveling effect. Section 7 builds on the findings of Section 6 and illustrates the changes in average activation times during periods of high, medium and low workload. The penultimate section of the report provides a breakdown of the average time for each phase in the incident lifecycle to be completed, which is followed in the final section by an overall summary.

The following segments of this section provide some background on the control centre and its area of responsibility. This is followed by a description of the incident lifecycle.

1.2 The Southern Region

The Southern Region is a combination of both the Otago and Southland regions, which combined cover an area of approximately 54,000 square kilometres. The usually resident population of this area based on the 2001 NZ Census is 272,541 although this figure varies during the tourist seasons. The Southern Region has two large cities, Dunedin and Invercargill, which have populations of 114,342 and 49,830 respectively (NZ Census, 2001). The remaining population is dispersed throughout the area in both low-density urban and rural locations.

1.3 The Control Centre

The St John's Ambulance Southern Region Control Centre (the control centre) is situated in the city of Dunedin. The control centre is responsible for the control of 56 ambulances stationed in 26 locations throughout the region. The ambulances are crewed by a combination of permanent and volunteer staff that have varying levels of training. In addition to the ambulances the control room staff are able to call on numerous helicopters that are dispersed throughout the region and are capable of responding to emergency incidents if required.

The role of the dispatchers in the control centre is to dispatch ambulances to emergency incidents as quickly as possible whilst managing other emergency incidents and patient transfer jobs that may be occurring simultaneously. In general there are two dispatchers working in the control centre at anyone time although this may increase to three during busy periods. When workload permits, the dispatchers work as a team to ensure ambulances are dispatched to incidents as quickly as possible. Often one controller takes details from the caller regarding the incident whilst the other controller dispatches ambulances as soon as the incident location becomes apparent. During periods when workload is heavy, dispatchers are able to manage the dispatch process individually. The same core of permanent staff has worked in the control centre for the duration of time this report is concerned with.

1.4 Incident Life Cycle

Figure 1.1 below illustrates the phases that a typical incident dealt with in the control centre progresses through. Incidents begin when a call is taken by one of the dispatchers in the control centre and progress through several phases until the ambulance is back on station (green). The first two phases, call received and crew notified, often overlap with one dispatcher recording the details of the incident whilst the other assigns the appropriate ambulance to the incident. The period of time between when the call is received and when a crew responds is defined as the activation time. It is this measure that is used for the purposes of this report to determine performance in the control centre. The response time and on location time are alternative measures of control room performance. However these measures are not only reliant on performance in the control room but other uncontrollable variables such as travel time and crew mobilisation time. The measure of incident duration is used in latter sections of this report as an indication of the total period of time an average incident takes.

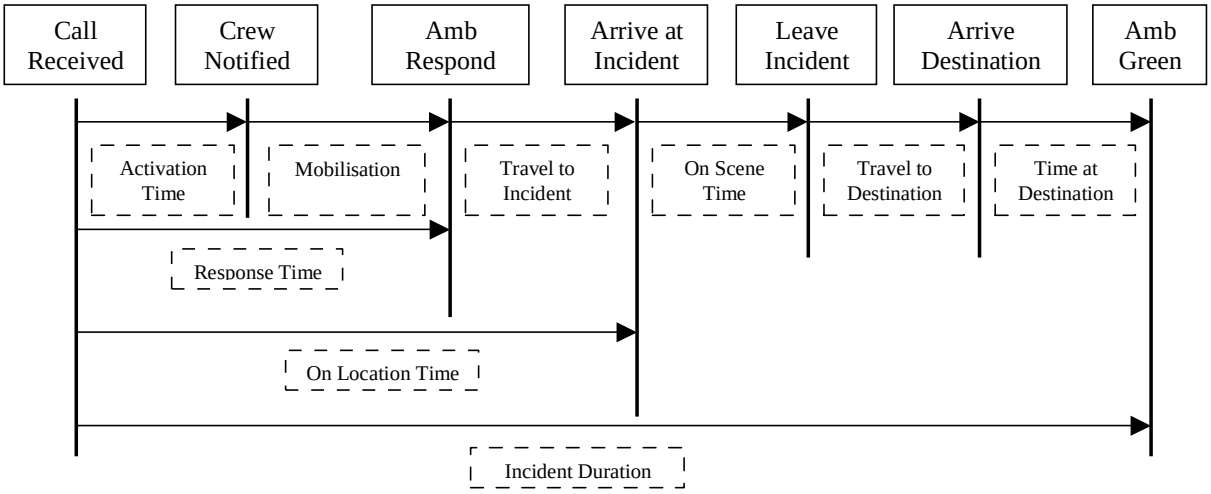

Figure 1.1: Incident Life Cycle

2 Workload Profile

2.1 Overview

This section outlines the changes in workload that occurred in the control centre between 1st January 1997 and 31st December 2001. Included are figures representing increases in both workload and dispatch occurrences. Following this, further examples of changes in workload are evident from the figures illustrating the increases in the number of emergency calls compared to the number of patient transfers and the increase in single response calls in comparison to increases in multiple response calls. The final segment details the distribution of rural and urban incidents.

2.2 Overall Workload

Figure 2.1 illustrates an increase in the number of incidents handled in the control centre between 1997 and 2001. In 1997 the total number of incidents handled was 22,311. By 2001 this number had increased by 4,862 or 21.8% to 26,696.

The largest increase in incidents occurred between 1999 and 2001. During this period the number of incidents increased by 2,450 (11%) from 22,275 to 24,725. Another large increase occurred between 2000 and 2001. During this period, the number of incidents increased from 24,725 to 26,696. This was an increase of 1,971 or 8%.

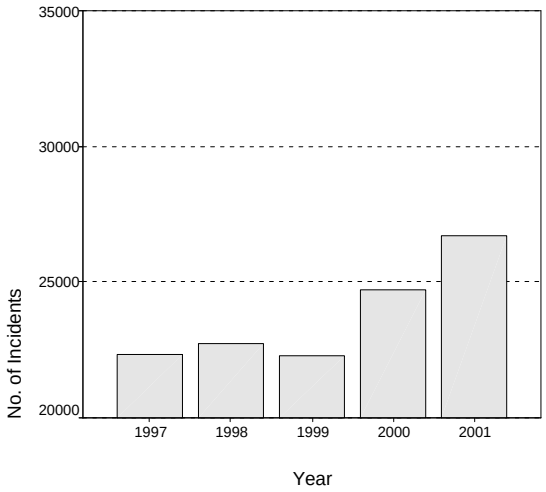

Figure 2.1: Increase in Total Number of Incidents per Year

The total number of dispatch occurrences (figure 2.2) has increased in a similar fashion to the total number of incidents. A dispatch occurrence is recorded every time an ambulance is dispatched to an incident. For example if three ambulances were dispatched to the same incident, this would be recorded as three dispatch occurrences. Overall the number of dispatch occurrences increased by 5,198 (20.4%) between 1997 and 2001. As expected the biggest yearly increases in dispatch occurrences eventuated between 1999-2000 and 2000-2001 (the same years as large increases in the number of incidents). The increases during these periods were 2,745 (10.7%) between 1999 and 2000, and 2,362 (8%) between 2000 and 2001. It is important to bear in mind whilst considering these results that the number of ambulances available to the controllers to dispatch to incidents has remained constant throughout the period this report is concerned with.

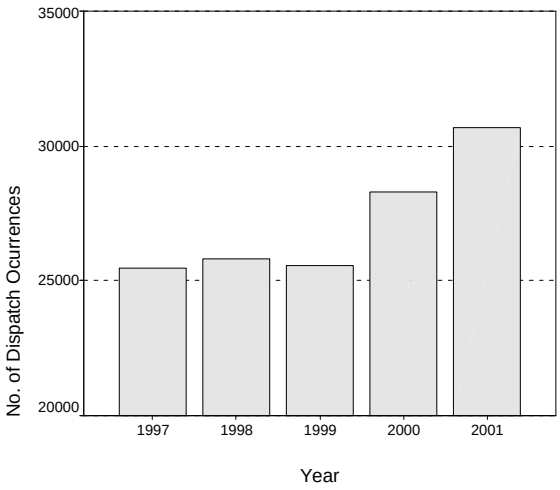

Figure 2.2: Increase in Total Number of Dispatch Occurrences

2.3 Incident Characteristics

The largest contributor to the increase in incidents handled by the control centre was an increase in emergency incidents, as illustrated in figure 2.3. In 1997 the number of recorded emergency incidents totalled 15,091. However in 2001 this number increased by 5,055 (33.5%) to 20,146. Like previous figures the largest increases occurred between 1999-2000 and 2000-2001. During these periods there were increases of 2,087 and 1,444 respectively. In comparison the number of patient transfers requiring ambulances under the control centres direction decreased by 1,618 from 7,841 in 1997 to 6,223 in 1999. Since 1999 the number of patient transfer incidents increased such that in 2001 there were 7,294 patient transfer jobs.

Therefore based on this data it is evident that along with the total increase in incidents as illustrated in figure 2.1, a larger proportion of the incidents are emergency incidents as opposed to patient transfers. In 1997 patient transfers made up approximately 48% of the total number of incidents whilst in 2001 patient transfers contributed to approximately 33% of the total number of incidents.

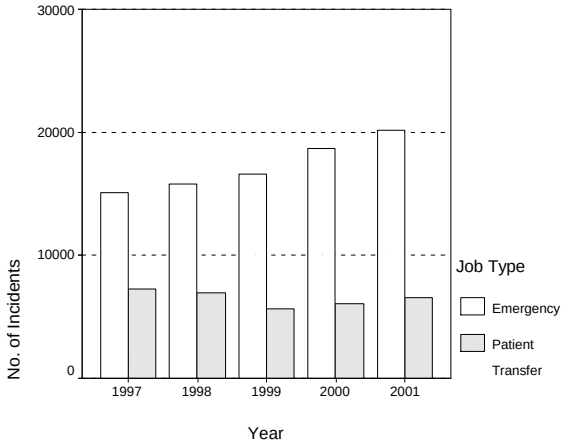

Figure 2.3: Number of Patient Transfers and Emergency Incidents Each Year

Figure 2.4 illustrates the increase in both multiple response and single response incidents. The total number of incidents requiring multiple ambulances to respond increased from 2,559 in 1997 to 3,379 in 2001. This was an increase of 820 incidents or 32%. Incidents requiring a single ambulance to respond also increased between 1997 and 2001. During this period they increased by 3,565 or 18%. However since 1999, which had the lowest recorded number of single ambulance response, there was an increase of 3,752 in the number of single response incidents from 19,565 in 1999 to 23,317 in 2001.

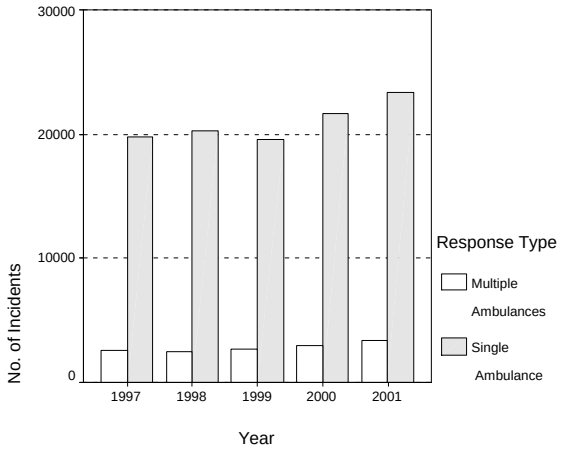

Figure 2.4: Number of Single Response And Multiple Incidents Each Year

2.4 Incident Locations

For the purposes of this report those incidents that occurred in either Invercargill or Dunedin have been classified as urban incidents whilst the remaining incidents have been classified as rural. As can be seen from figure 2.5 the number of incidents occurring in rural areas constantly increased between 1997 and 2001. In 1997 a total of 9,710 incidents occurred in rural areas compared to 12,683 in 2001. The number of incidents occurring in urban areas did not follow the same trend with a reduction between 1997 and 1999. However since 1999 the number of incidents occurring in urban areas increased from 11,669 to 14,013. In 1997 rural incidents accounted for 44% of the total number of incidents, whilst in 2001 47% of the 26,696 incidents occurred in rural areas.

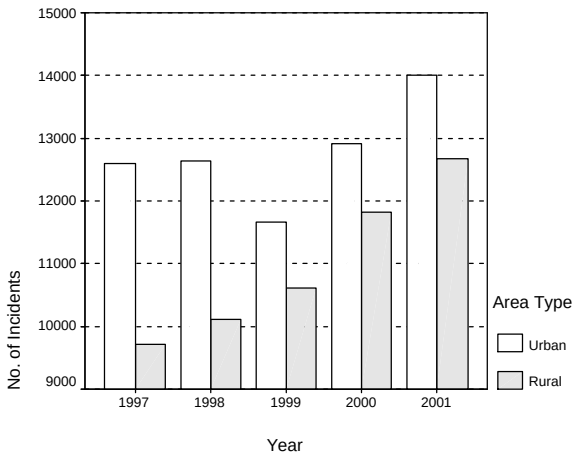

Figure 2.5: Increase in Rural and Urban Incidents

2.5 Discussion

Between 1997 and 2001 there was a 21.8% increase in the number of incidents handled by the control centre. A large proportion of this increase in incidents came as a direct result of the increase in emergency jobs. In comparison patient transfers had little influence on the increase in incidents, as they remained relatively constant between 1997 and 2001. Other points of note from this section include the increases in both single response and multiple response incidents and an increase in the total percentage of jobs occurring in rural areas.

3 Dispatch Profile

3.1 Overview

This section focuses specifically on the stages in the incident life cycle from when a call is received to when the ambulance arrives at the location of the incident. Throughout the section graphs are reported that illustrate average times for the various stages in the life cycle. Unless it is otherwise stated all times calculated are for emergency incidents and where multiple ambulances were dispatched only the first dispatched ambulance is considered in these results.

3.2 Activation Times

Figure 3.1 is based on the activation times for all dispatch occurrences and illustrates a continual increase in activation times between 1997 and 2001. This was a 44 second increase from an average of 1.40min in 1997 to 2.24min in 2001. The largest increase occurred between 2000 and 2001 where the average activation time increased by 30 seconds from 1.54min to 2.24min. From the data analysed to prepare this report it is impossible to determine the exact cause of this increase although the large increases in incident numbers stands out as a one strong possible contender for this pattern of results.

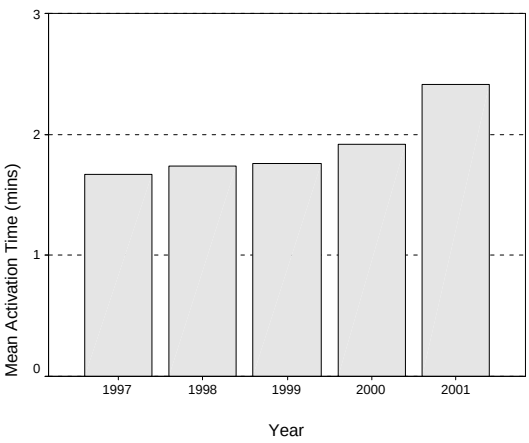

Figure 3.1: Increase in Average Activation Time

3.3 Mobilisation Times

The average mobilisation time for crews responding to incidents in the Southern Region between 1997 and 2001 remained within a range of 22 seconds. The largest average mobilisation time occurred in 1998 with a time of 2.28min. However since 1998 the average mobilisation time has decreased every year and in 2001 was 2.15min.

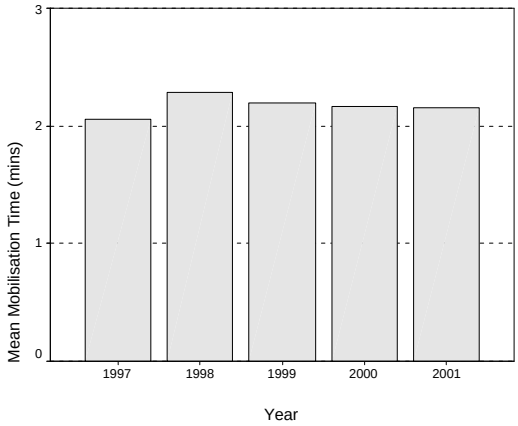

Figure 3.2: Average Mobilisation Times

3.4 Response Times

The average response times for emergency incidents in the Southern Region follows a similar pattern to the previous graph illustrating the average activation times. Between 1997 and 2001 there was an increase of 45 seconds. In 1997 the average response time was 3.35min whilst in 2001 it was 4.20min. The only difference between the average activation times and the average response times graph is a larger response time in 1998 compared to the 1998 activation time. As the response time is a combination of both activation time and mobilisation time the increased response time in 1998 can be attributed to the high mobilisation time in 1998.

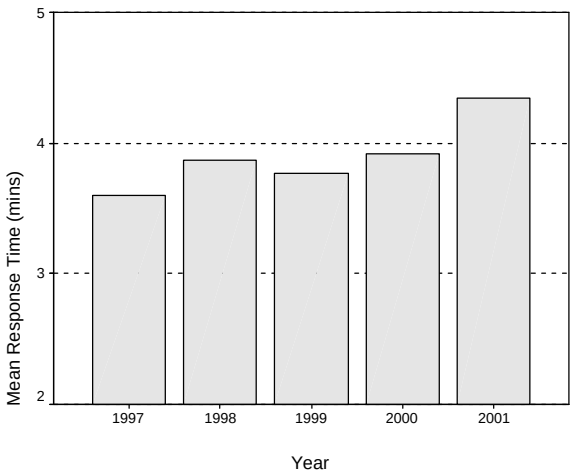

Figure 3.3: Increase in Average Response Times

3.5 Travel Times

Average travel times for incidents in the Southern Region increased between 1999 and 2001. In 1999 the average travel time was 6.25min whilst in 2001 this time was 7.01min. One possible explanation for this increase is the increase in the occurrence of rural incidents in 2000 and 2001.

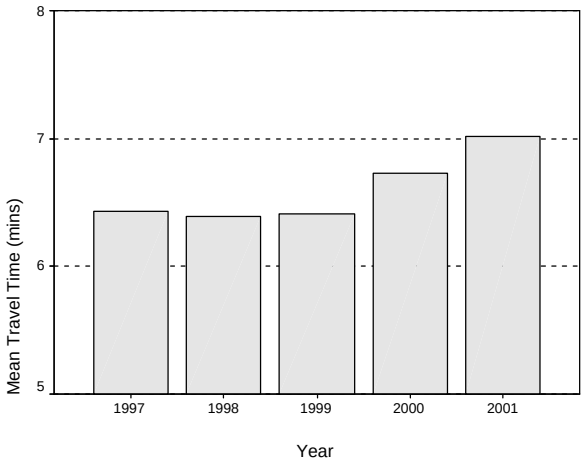

Figure 3.4: Increase in Average Travel Time

3.6 On Location Times

The on location times are a reflection of the previous four figures. Overall the average time taken for an ambulance to arrive at the location of an incident has increased from 9.53min in 1997 to 11.11min in 2001. This is an increase of 1.18min. The single largest contributor to the increase in on location times was the increase in average travel time, although increased activation times have also contributed to this effect. Provided dispatchers send the ambulance that will arrive at the scene of the incident first, the only areas where improvements to the on location times can be made are during the activation period and the mobilisation period.

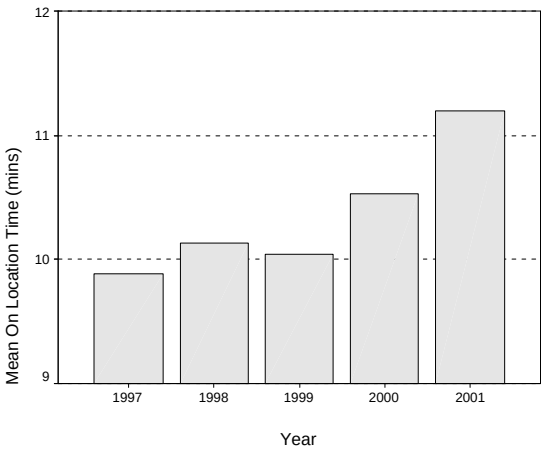

Figure 3.5: Increase in Average On Location Times

3.7 Discussion

This section has outlined several areas where the average times recorded by the system in the control centre increased. The first of these was activation time, which increased by 44 seconds between 1997 and 2001. Latter sections of this report will examine more specifically the effects that increased workload has on activation times.

Like average activation time the average response times increased in a similar manner, with a 45 second increase between 1997 and 2001. During this same time period there was no definite pattern of changes in mobilisation time, with the average mobilisation times for all five years being within 22 seconds. Average travel times increased by 36 seconds between 1997 and 2001. One possible explanation for this is the increase in rural incidents. An alternative explanation is that the increasing number of incidents each year is leaving resources spread thinly in some areas and therefore ambulances are required to travel further to cover these areas. The final figure in this section illustrates the increase in average times for an ambulance to arrive at an incident, which increased by 1.18min between 1997 and 2001.

4 Multiple Response Activation Times

Multiple response incidents are those incidents where one or more ambulances are required to adequately deal with all patients at the incident. Figure 4.1 illustrates the increase in average activation times between 1997 and 2001 for single response incidents and the first ambulance sent to multiple response incidents.

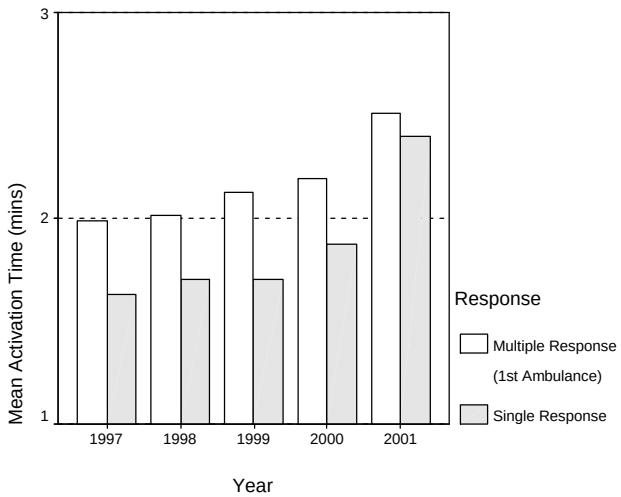

Figure 4.1: Activation Time of Single Response Incidents and 1st Ambulance sent to Multiple Response Incidents

As can be seen from this figure, activation times for the first ambulance sent to a multiple response incident were on average approximately 15 seconds higher than for single response incidents. The obvious exception is in 2001 where the activation time for single response incidents increased by 31 seconds from 2000 and is only marginally less than

the average activation time for the first ambulance sent to a multiple response incident. A possible explanation for the higher activation times of multiple response incidents is the extra planning capacity required when sending multiple ambulances to ensure that all remaining areas have the appropriate coverage.

5 Urban vs. Rural Activation Times

Figure 5.1 illustrates the average activation time for the areas classified as rural and urban (see section 2.4 for classification). Most notable in this figure is the constant increase in activation times for urban areas and the large increase in activation times for rural areas between 2000 and 2001. In terms of activation times for urban areas this increased by 52 seconds from 1:26min in 1997 to 2:18min in 2001. The activation times for rural areas increased by 33 seconds from 1:58min in 2000 to 2:31min in 2001.

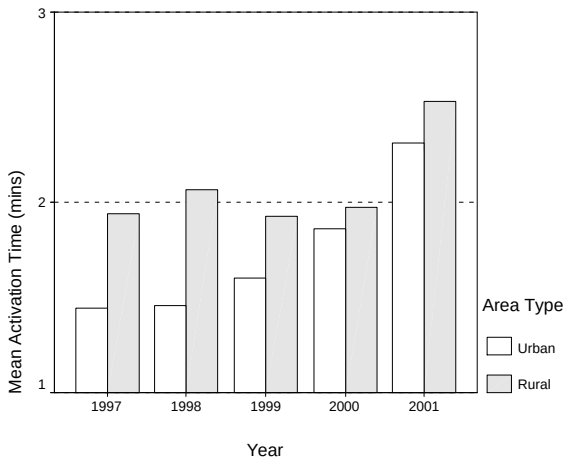

Figure 5.1: Comparison of Activation times for Rural and Urban Areas

6 Workload Effects

6.1 Overview

This section outlines a series of five graphs (Appendix I) illustrating the impact of increased workload in the control centre on activation times. In these graphs the number of jobs per hour (workload) is displayed on the horizontal axis. This includes the total number of emergency incidents and patient transfers. The vertical axis displays the average activation time in minutes. The times used to calculate activation times in this figure are the activation times for all single response emergency incidents and the activation time for the first ambulance sent to a multiple response emergency incident.

The small numbers displayed by each of the markers in the graph represent the hour of the day (e.g. the number 4 represents 4am whilst the number 16 represents 4pm).

6.2 Effect of Workload on Activation Times (1997 to 2001)

Figures 10.1 and 10.2 are similar in that there is an obvious increase in activation times as workload increases. Also evident in these two figures are distinct clusters of data points at both low workloads and high workloads.

Figure 10.3 is similar to the previous figures in regards to clear evidence of increasing dispatch times as workload increases. However in this figure the left hand end of the line has increased and there is a decrease in the number of hours when workload was greater than five.

Figure 10.4 provides the first evidence of a levelling effect where activation times during low workload periods increased faster than those during high workload periods causing the line to level. Also of note in this figure is the shifting to the right of many of the data points indicating an increase in workload in 2000 (consistent with findings from earlier sections) and the left hand end of the line climbing past one minute on the activation time axis.

The final figure in this section (figure 10.5) provides the strongest evidence of a levelling effect. Whilst both ends of the line have climbed since 2000, the left hand end of the line has increased a greater amount. This figure also indicates further increases in workload during most hours of the day as the majority of data points have shifted to the right. Finally unlike previous graphs where the data points are relatively close to the line in figure 10.5 there is a greater vertical spread of data points.

6.3 Discussion

The figures in this section show a clear link between increases in workload and increases in activation times between 1997 and 2001. Also of note is the levelling effect in which the activation times during periods of low workload are increasing faster than the activation times during high workload periods causing the line to level. Section 7 examines the levelling effect further.

7 Activation Times During High, Medium and Low Workload Periods

7.1 Overview

This section outlines the change in activation times during periods of high, medium and low workload between 1997 and 2001. The approximate workload classifications are as follows:

- high workload : greater than 4 calls per hour
- medium workload: 2.5 to 4 calls per hour
- low workload: 0 to 2.5 calls per hour.

7.2 Increased Activation Times During Workload Periods

As can be seen from figure 7.1 there was an overall increase in activation times for all of the workload classifications. However the largest increases have been for the low and medium workload classifications. Between 1997 and 2001 the average activation times for periods when the workload was low increased by 47 seconds from 1.11min to 1.58min. A similar pattern occurred under medium workload conditions where average activation times increased by 36 seconds from 1.17min to 1.53min. In comparison activation times in high workload conditions remained relatively constant between 1997 and 2000. However there was an increase of 20 seconds between 2000 and 2001. Based on this it can be concluded that whilst the activation times during all periods of workload increased, it was during periods of low and medium workloads where the greatest increases occurred, thus causing the levelling effect identified in section 6.

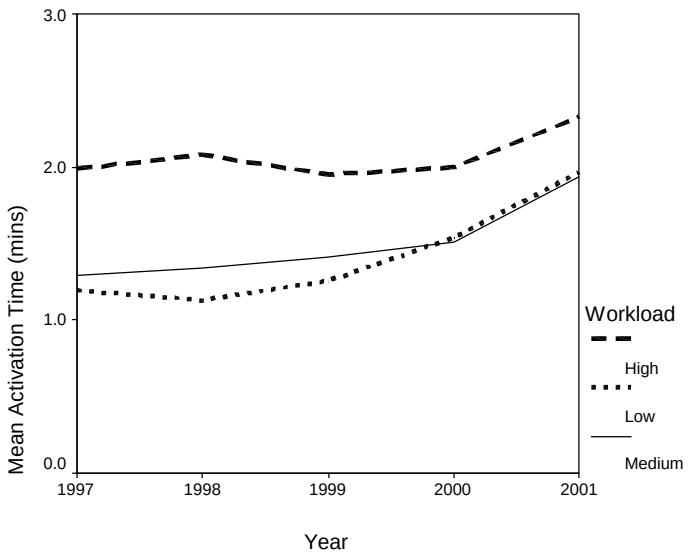

Figure 7.1: Increased Activation Times for High, Medium and Low Workload Periods.

8 Incident Durations

Figure 8.1 provides a breakdown of the phases that make up the total duration of an emergency incident. As can be seen, the total average duration of emergency incidents increased by approximately 5 minutes between 1997 and 2001. One of the factors that prevented the total duration of emergency incidents increasing further in 2001 was the decrease in time from when the ambulance is at the incident location until when the ambulance is green. If this measure had remained the same between 2000 and 2001 the incident duration in 2001 would have increased further. It is also evident from figure 7.1 that there has been a large increase in activation times between 1997 and 2001 and that this has flow on effects in latter stages of the incident lifecycle.

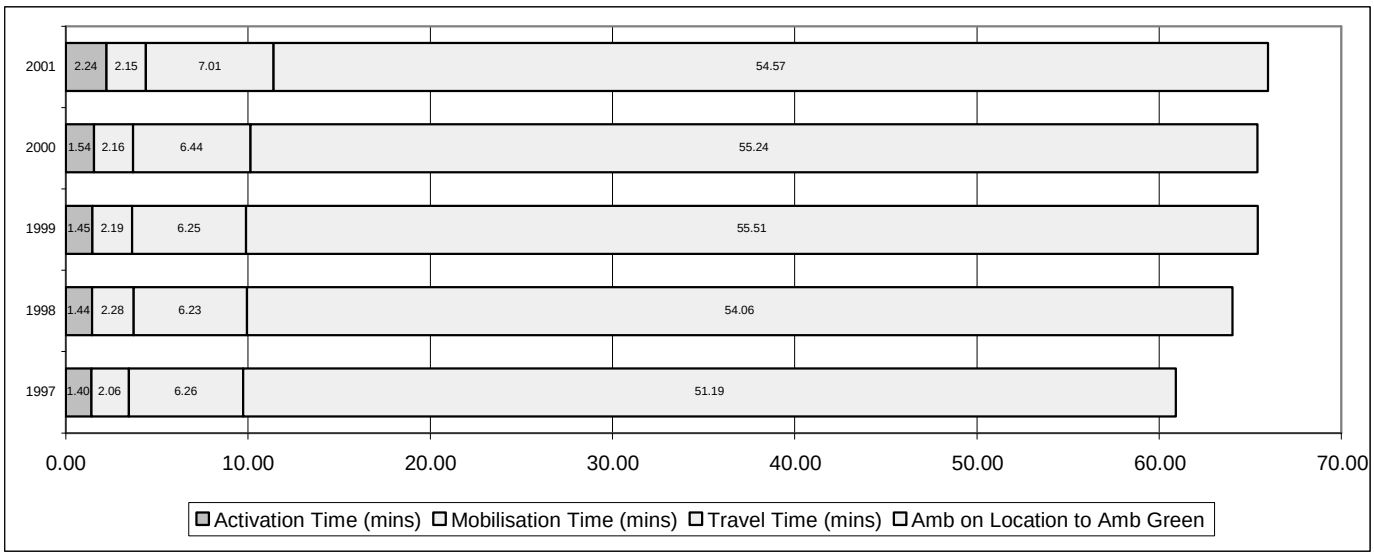

Figure 8.1: Incident Durations

9 Summary

The Southern Region control centre is responsible for an area of 54,000 square kilometers and a usually resident population of 272,541 (NZ Census, 2001). Within this area 56 ambulances located in 26 stations are available to respond to emergency incidents and patient transfers. In conjunction with the ambulances, several helicopters spread throughout the region are also capable of responding to emergency incidents.

The number of emergency incidents handled in the control centre between 1997 and 2001 increased by 21.8% from 22,311 in 1997 to 26,696 in 2001. This increase occurred as a result of an increase in emergency incidents rather than patient transfers. In 1997 emergency incidents accounted for 52% of the total workload whilst in 2001 this had increased to 67%. The distribution of workload also changed with rural incidents in 2001 contributing 47% of the total number of incidents compared to 44% in 1997.

Like the increase in workload, this report has documented an increase in the average times for many phases of the incident lifecycle. This included average activation times, which increased by 44 seconds between 1997 and 2001 and as a consequence of this average response times, which increased by 45 seconds. These increases along with the increase in average travel time resulted in the average on location time increasing by 1.18min.

Other areas of note in this report were the higher average activation times for incidents that required multiple ambulances to respond rather than single ambulance incidents and the constantly increasing activation times for urban incidents. The activation times for multiple response incidents were approximately 15 seconds more than for single response incidents whilst the activation times for urban incidents climbed from 1.26min in 1997 to 2.18min in 2001.

There is also a clear link between workload and activation times based on the data in this report. In each of the years from 1997 to 2001, the average activation times for emergency incidents increased as the workload increased. There was also evidence that the activation times during low and medium workload periods were increasing at a greater rate than the activation times during high workloads. This was termed the levelling effect.

Based on the data analysed to produce this report it is impossible to confirm a valid explanation that accounts for the increases in various phases of the incident lifecycle and the levelling effect mentioned above. Although possible causes could include the control centre reaching the limits of its capacity, a shortage in the number of ambulances available to respond to emergency incidents or the increase in the number of incidents in rural areas requiring more time for dispatchers to confirm incident locations.

Appendix I

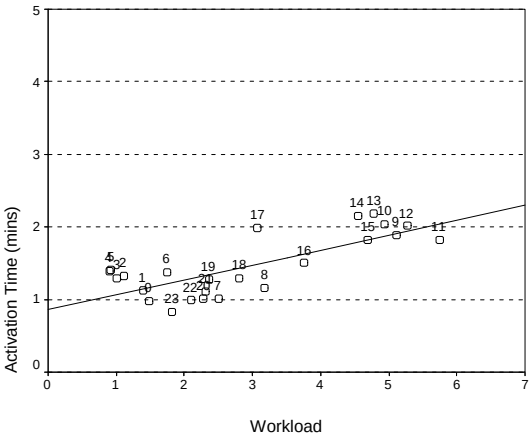

Figure 10.1: Activation Time vs. Workload (1997)

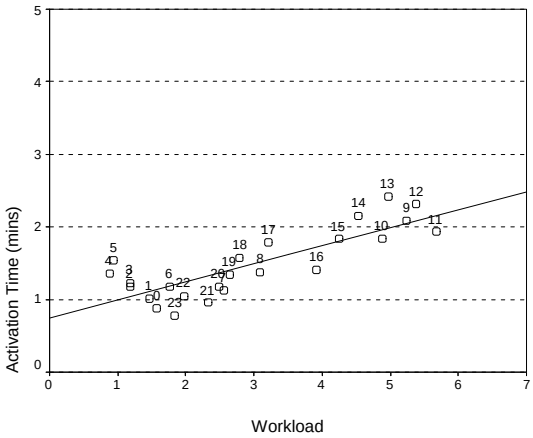

Figure 10.2: Activation Time vs. Workload (1998)

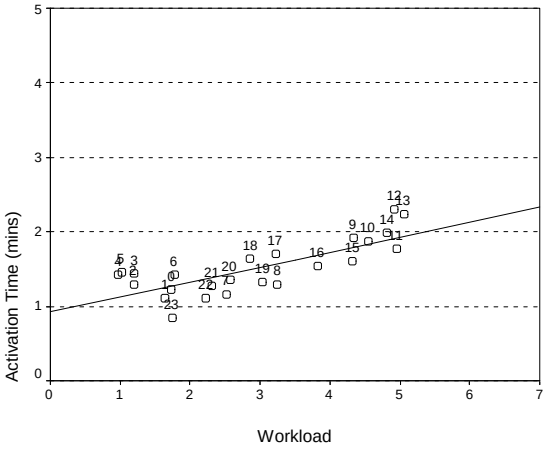

Figure 10.3: Activation Time vs. Workload (1999)

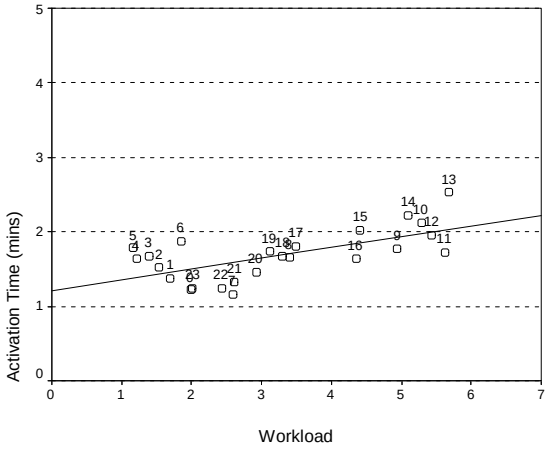

Figure 10.4: Activation Time vs. Workload (2000)

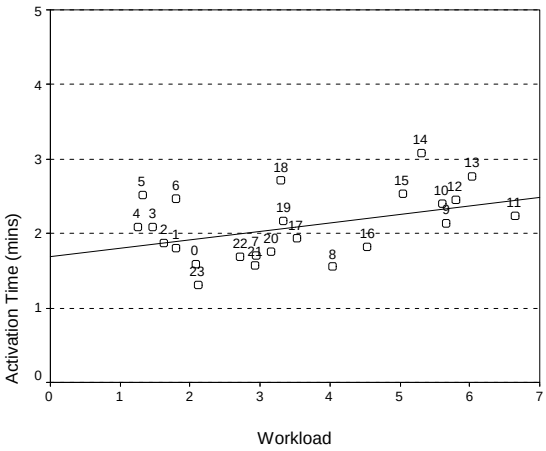

Figure 10.5: Activation Time vs Workload (2001)