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Assessing the impact of Site Safe

Findings from data analysis and literature review

Report to Site Safe (final version)

February 2008

Preface

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Authorship

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Executive Summary

Introduction

Site Safe commissioned NZIER to conduct an independent economic impact assessment study. This report presents our findings from the study.

The study was conducted during December 2007-January 2008. The main activity was an analysis of claim statistics from the Accident Compensation Corporation (ACC), supplemented by a brief literature review.

We examined the extent to which Site Safe's services have had a measurable effect on injury rates in the industries in which it operates, and the economic value (to society, as well as to ACC) attributable to any reduction in injury rates. Note, however, that our approach does not constitute a full cost-benefit analysis of Site Safe's services.

We compared injury rates for a sample of Site Safe's clients which have had considerable exposure to Site Safe's services ("the Site Safe sample") with those for all other companies for which ACC has records in the same industries ("the non-sample companies"), over two time periods (2002-4 and 2005-7). The Site Safe sample comprised around 380 companies and the non-sample around 287,000 companies. At the most disaggregated industry level, the non residential building construction industry accounted for the largest share of the Site Safe sample. Our analysis therefore focused on this industry.

What we found

In very broad terms, injury rates fell for both the Site Safe sample and the non-sample companies between 2002-4 and 2005-7, although there was some variation at an individual industry level. This reflects the international trend of declining injury rates, both within the construction industry and in many other industries, picked up in our brief literature review.

We found that in the non residential building construction industry, the performance for the Site Safe sample in terms of injury rate improvements was considerably better than for the non-sample companies. The picture was more complex for other industries, where in many cases the Site Safe sample was small.

If improved injury rates for the Site Safe sample are assumed to be solely attributable to Site Safe's involvement, then the analysis indicates substantial contribution by Site Safe in some industries, particularly in non residential building construction. In this industry, there were savings in life time costs of ACC claims of about $1 million per year in relation to the Site Safe sample. Also there was national benefit of about $8 million per year in terms of savings in social costs in relation to the Site Safe sample. In other industries the savings (or otherwise) in lifetime costs were relatively small.

Conclusion

There are many factors other than Site Safe which may account for the differences in performance between the Site Safe sample than the non-sample companies. Declining injury rates may be attributable to factors such as technological improvements and government policy, identified in our brief literature review.

In terms of the savings in life time costs to ACC and the savings in social costs, it is not possible to extrapolate the findings for the Site Safe sample across Site Safe's entire client base due to the way in which the sample was constructed.

However, overall we conclude that Site Safe appears to have had a positive impact on injury rates in the non residential building construction industry.

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1. Introduction

1.1 Why this study was commissioned

Site Safe has recently experienced funding cuts, and is in the process of sourcing new funding streams from various government agencies.

In order to present a compelling case for funding to the relevant government agencies, Site Safe commissioned NZIER to conduct an *independent* economic impact assessment study of its various training and health and safety programmes. This report presents our findings from the study.

1.2 The aims of the study

The main aim of the study was to assess the economic impact of Site Safe's services. Key requirements were that the impact assessment must be credible, it must stand up to scrutiny, and that it be undertaken relatively quickly.

1.3 About Site Safe

Site Safe was launched in 1999 with a principal objective of preventing harm to employees at work in the construction industry.

Site Safe offers a range of training courses and other services.

The non residential building construction industry is that, among the various sub-industries within the overall construction industry, in which the take-up of Site Safe's services has been greatest. We understand from Site Safe that completion of a Site Safe Passport course has become a mandatory requirement for all employees before being admitted on most commercial sites in New Zealand.

A fuller description of Site Safe's services and the number of participants in two major services is provided in Appendix C.

1.4 Our approach

The study was conducted during December 2007-January 2008. The main activity was an economic impact assessment based on an analysis of data from the Accident Compensation Corporation (ACC), discussed further below. We would like to express our thanks to ACC personnel for their assistance with the study and providing data within the relatively tight timelines.

The economic impact assessment was supplemented by a brief literature review of injury rate trends in selected developed countries, aimed at providing some context for the Site Safe-specific analysis.

1.4.1 Overview of economic impact assessment

The purpose of the economic impact assessment was to assess the extent to which Site Safe's services have had a measurable effect on injury rates in the industries in which it operates, and the economic value (to society, as well as to ACC) attributable to any reduction in injury rates.[1] Note, however, that we have not undertaken a full cost-benefit analysis. For example, we have not taken into account the costs of Site Safe's services.

We compared injury rates for a sample of Site Safe's clients ("the Site Safe sample") with those for all other companies for which ACC has records in the same industries ("the non-sample companies"), over two time periods (2002-4 and 2005-7).[2] Comparing injury rates both *between the Site Safe sample and non-sample companies* and *between time periods* enabled us to assess Site Safe's impact.[3]

We obtained customised data from ACC to examine injury rates. We used claim numbers/costs divided by liable earnings as a proxy for injury rates, as ACC is unable to provide information on the number of employees.

For confidentiality reasons, ACC does not provide data at an individual employee or company level. We therefore conducted the analysis at an industry level; ACC grouped the data for individual companies according to the industry classification contained in their records. The industry classification system used by ACC is the Australian and New Zealand Standard Industrial Classification (ANZSIC) 1996.[4] Where possible we used the most detailed ANZSIC industry breakdowns available from ACC, as injury rates and trends can vary substantially between the various sub-industries within the construction industry (discussed in the literature review in section 3). However, ACC was only able to provide data at the most detailed industry level where this did not breach their confidentiality rules.

1.4.2 Site Safe sample

The Site Safe sample of companies was extracted by Site Safe from its database. The selection criteria was that the companies had had "maximum exposure" to Site Safe's services over an extended period. Specifically, the companies selected had been members of Site Safe throughout the period 2002-2005, and one or more of their staff had undertaken Site Safe's Gold Card and Passport courses during

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[1] Positive (and negative) externalities may arise from Site Safe's programmes. In other words, people and organisations other than those which pay for them may benefit from them. When an employee receives training while working for a firm and then moves to another firm, the receiving firm receives positive externality and the other firm suffers. Also, positive externality emerges from involvement of other workers with Site Safe trained workers.

[2] Years ending March

[3] Our approach aimed at developing an appropriate "counter-factual" i.e. an examination of the situation which would have prevailed in the absence of Site Safe

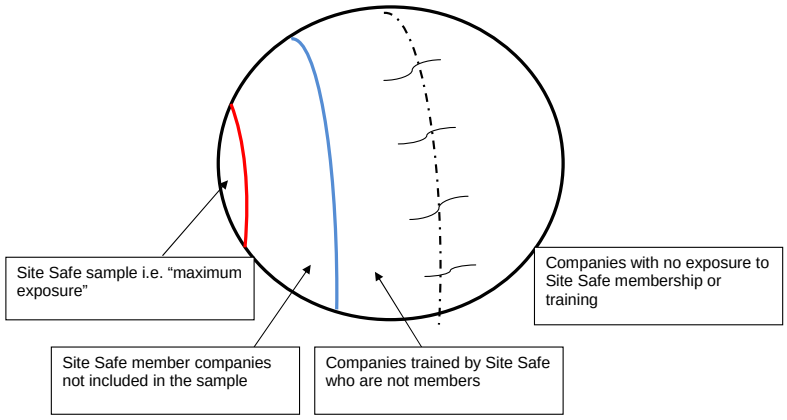
[4] For further details on the ANZSIC system, and a description of the individual classifications used in this report, see http://www.stats.govt.nz/statistical-methods/classifications-and-related-statistical-standards/industrial-classification/industrial+classification+1996.htm

this period (see Appendix C for a description of these services). The Site Safe sample of companies had therefore experienced Site Safe's services aimed at changing both safety culture at a management level within a company (Gold Card) and improving safety across the company's entire workforce (Passport).

The underlying rationale for the selection criteria is that Site Safe is likely to have had the greatest (and therefore most measurable) effect over time on injury rates among the maximum exposure group, compared with other groups in its client base. However, this approach means that it is not possible to extrapolate the results for the Site Safe sample across Site Safe's entire client base.

An important point to note is that the non-sample companies include some which have had some exposure to Site Safe's services, but less than the Site Safe sample. The situation is depicted in the figure below.

Figure 1 Site safe sample



Source: Site Safe/NZIER

A further important point to note is that the Site Safe sample comprised essentially the same group of companies throughout the entire period of analysis (i.e. 2002 to 2007). Whilst there was some year-on-year variation in the size of the Site Safe sample, this was (presumably) due to changes in classifications in ACC's records.

The Site Safe sample comprised 385 companies on average per year between 2002 to 2007. Over the same period, the number of non-sample companies averaged 287,000 per year.

The industry breakdown for the Site Safe sample in 2007 is shown in Table 1 below.

Table 1 Site Safe sample

Number of companies, year ending March 2007

Industry (ANZSIC level four)	Number of companies
Structural steel fabricating	7
Non-residential building construction	53
Air conditioning and heating services	10
Security and alarm system installation	2
Painting and decorating services	18
Other	290
Total	380

Source: ACC

At this level of detail (ANZSIC level four), the non residential building construction industry accounts for the largest share of the sample of any individual industry. Our report therefore focuses on this industry.

Note that the sample size for the other (level four) industries is in some cases very small. Also note the large residual - the figure of 290 relating to "other" industries. This shows that companies in the Site Safe sample were spread among a wide range of other industries, including some outside construction. However, care should be taken with interpreting the industry classifications on ACC's database. As noted in our literature review (see section 3), companies may have an incentive to classify themselves in a lower risk industry to that in which they in fact operate.

1.5 Structure of the report

After an introduction of the study's aims and methodology (this section) we report on the Site Safe-specific analysis (section 2) and then provide some context for that analysis (section 3) before providing some brief conclusions (section 4).

2. Site Safe-specific analysis

The following analyses were carried out.

- The trend in claim numbers and claim costs between the Site Safe sample and the non-sample companies.
- Estimates of savings in life time claim costs for claims occurring in the last three years (year ending March 2005-7).
- Estimates of savings in social costs for claims occurring in the last three years (year ending March 2005-7).

2.1 Industry classifications

ANZSIC is a hierarchical classification system. The structure is based on four levels of classification, each of which drill down into successive degrees of detail. For example, across *all* industries in New Zealand there are 17 ANZSIC classifications at the most aggregated level (level one) of which one is Construction, and 476 at the most detailed level (level four). A full description of each ANZSIC classification, and the classification structure, is contained on Statistics New Zealand's website.[5]

As noted in section 1, most of our analysis was undertaken at the most detailed ANZSIC code level – level four.

However, in the trend analysis in section 2.3 below we provide some analysis at greater levels of industry aggregation for selected classifications – see below.[6] The number of companies in the Site Safe sample in 2007 is indicated in brackets after the classification name. The key point to note is that, at ANZSIC level four, non-residential building construction accounts for the largest share of the Site Safe sample of any individual industry.

1. Level one
   - Construction (241)
2. Level two
   - General construction (99)
   - Construction trade services (142)
3. Level three
   - Building construction (83)
   - Non-building construction (16)

[5] See http://www.stats.govt.nz/statistical-methods/classifications-and-related-statistical-standards/industrial-classification/industrial+classification+1996.htm

[6] Note that, due to time constraints, we have not included in this report an analysis for all the industry classifications for which ACC provided data. For example, other than at ANZSIC level four we have excluded classifications outside the construction industry.

4. Level four
   - Structural steel fabricating (7)
   - Non-residential building construction (53)
   - Air conditioning and heating services (10)
   - Security and alarm system installation (2)
   - Painting and decorating services (18)

2.2 ACC claim statistics

Under the Injury Prevention, Rehabilitation, and Compensation Act 2001 ACC provides compensation for injuries and occupational diseases. Those affected or their care givers lodge claims to ACC for compensation.

The claims are grouped into two main categories: medical fee only and entitlement claims. The entitlement claims include payment of weekly compensation, the independence allowance, rehabilitation costs, or death benefits.

Our analysis is based on:

- all new claims
- new entitlement claims.

2.3 Trend analysis

There are many factors that cannot be controlled for in comparing claim statistics for the Site Safe sample and the non-sample companies. To make the comparison valid, we need to reduce heterogeneity within each group in term of company size and structure, to the extent possible from the available data. Bearing this in mind, we have looked at ACC claim data for only the same groups of ANZSIC codes, for both the Site Safe sample and the non-sample companies.

The risk of injury at the workplace is indicated by the level of claims to ACC. However, the level is expected to vary between companies by the level of employment. The effect of Site Safe's services to a company will also depend on the initial risk the company had before it started using Site Safe's services.

For confidentiality reasons, ACC does not provide data by individual company and also no information is available on the number of employees.

In the absence of level of employment statistics we have used liable earnings to normalise claim statistics.[7]

Since wage rates have changed over time, the number of claims per $1 million liable earnings does not indicate the same claim rate over time. The rates would

[7] "Normalise" means to conform to a standard. The number of claims depends on the size of firms included in the claim statistics. Therefore, for comparison purposes we need to ensure that it has the same domain. This has been achieved by comparing claims and their costs for the same levels of liable earnings.

be over estimated in earlier years. To avoid this problem we have expressed liable earnings at 2007 prices for all years to estimate the rate of number of claims per $1 million liable earnings.[8]

Due to the stochastic variation in injury occurrence and hence claims by year,[9] particularly where the number of employees under consideration is not large, a year to year comparison is unlikely to provide robust estimates. To address this we have considered differences in average risks over three year periods (2002-4 and 2005-7). The differences observed would be the effect of Site Safe on the Site Safe sample if there were no other interventions. In reality that may not be the case i.e. there are many factors other than Site Safe which may account for the differences. Some of these other factors, such as firm size, technological improvements and government policy, have been identified in our brief literature review in section 3.

As well as considering the performance of the Site Safe sample between the two time periods, we also compare the performance of the Site Safe sample and the non-sample companies. If the risk for the non-sample companies changed by α proportion between the two time periods, it is possible that the risk for the Site Safe sample would also have changed by α proportion if they were not involved with Site Safe's services. However, we reiterate that many other factors may come into play, so it is difficult to know the extent to which this is a valid assumption.

2.3.1 Level 1: Construction

The number of companies in the Site Safe sample for this, the broadest ANZSIC classification for the construction industry, is between 185 and 290 between years.

We looked at claim figures for the period 2002-4 and for 2005-7. The number of new entitlement claims per $1 million liable earnings for non-sample companies reduced in 2005-7 by about 5% in comparison with the period 2002-4. During the same period the rate of new entitlement claims reduced by about 10% for the Site Safe sample. For all claims, these rates were 11% for the non-sample companies and 15% for the Site Safe sample respectively (Table 2). However, we do not find the same relativity in the cost of new claims. The reductions were slightly higher for the non-sample companies than for the Site Safe sample.

[8] Ordinary time average hourly wage rate has been used for indexation.

[9] "Stochastic variation" means the variation does not have a definite pattern. Injuries are random events. Thus for a given system the number of injuries and their severity may vary from one year to another.

Table 2 Percentage change from 2002-2004 to 2005-2007

Industry	Company groups	Number of new claims per $1 million liable earnings		Cost of new claims per $1 million liable earnings	
		Entitlement	All	Entitlement	All
		%	%	%	%
Level 1: Construction	Site Safe sample	-10.3	-15.1	-8.6	-8.3
	Non-sample	-4.6	-11.4	-11.3	-10.4
Level 2: General construction	Site Safe sample	-25.2	15.0	-37.4	-34.3
	Non-sample	-2.2	-6.7	-7.7	-7.9
Level 2: Construction trade services	Site Safe sample	5.0	-16.4	24.4	21.2
	Non-sample	-6.3	-14.7	-14.3	-13.5
Level 3: Building construction	Site Safe sample	-28.3	-15.6	-42.8	-39.2
	Non-sample	-12.8	-13.9	-5.4	-5.0
Level 3: Non building construction	Site Safe sample	9.4	-10.3	18.6	16.5
	Non-sample	19.0	5.0	-15.3	-12.9
Level 4: Structural steel fabricating	Site Safe sample	45.8	6.1	-54.2	-51.0
	Non-sample	-0.9	5.9	-41.0	-38.5
Level 4: Non residential building construction	Site Safe sample	-34.0	-18.3	-47.0	-42.9
	Non-sample	-5.8	-1.2	20.3	20.3
Level 4: Air conditioning and heating services	Site Safe sample	20.5	-4.8	22.7	23.9
	Non-sample	-24.5	-21.1	-40.9	-38.6
Level 4: Security and alarm system installation	Site Safe sample	6.5	-20.5	-9.4	-13.2
	Non-sample	3.8	-13.2	-19.2	-18.0
Level 4: Painting and decorating services	Site Safe sample	21.9	10.2	-50.0	-48.7
	Non-sample	-4.9	-15.8	-22.1	-21.0

Notes: (1) All costs are expressed at 2007 prices

Source: ACC/NZIER

2.3.2 Level 2: General construction

The number of companies in the Site Safe sample for this classification varies from 69 and 124 between years.

General construction appears to be an area where Site Safe has contributed to considerable improvements. The rates of new entitlement claim numbers decreased for both the Site Safe sample and the non-sample companies. The reduction was considerably higher for the Site Safe sample. Interestingly, for all new claims the rate increased for the Site Safe sample but decreased for the non-sample companies (Table 2). While the cost of new claims per $1 million liable earnings reduced by 37% and 34% for entitlement claims and all claims

respectively for the Site Safe sample, the corresponding reductions for the non-sample companies were only about 8%.

2.3.3 Level 2: Construction trade services

The number of companies in the Site Safe sample is between 116 and 146 between years.

In this case while the rates for number of all new claims reduced by similar percentages for both the Site Safe sample and the non-sample companies, the rate of new entitlement claims increased for the Site Safe sample but reduced for the non-sample companies. The rates of claim costs increased for the Site Safe sample during 2005-7 but reduced for the non-sample companies. We notice that the number of claims and claim costs for the Site Safe sample increased substantially during the year ending March 2006 and the high level continued during the following year.

2.3.4 Level 3: Building and non building construction

The number of companies in the Site Safe sample in building construction is between 56 and 102 between years, and for non building construction is between 13 and 22 between years

As shown in Table 2 the performance of the Site Safe sample in building construction improved substantially both in the rate of new claim numbers and costs during 2005-7 from the level during 2002-4. The reduction was higher for claim costs per $1 million liable earnings than for the rate of number of claims. The rates reduced during the period for the non-sample companies as well but to a lesser extent.

The picture was different for non building construction. In this case, the number of firms in the Site Safe sample was low and the number of claims during a year varied between 5 and 14. Compared with the previous years, the claim costs were substantially higher during the two years ending March 2005 and March 2007.

2.3.5 Level 4: Structural steel fabricating

The number of companies in the Site Safe sample is small, varying only between 7 and 11 between years.

The claim statistics show some interesting results. For the Site Safe sample, the rate of number of claims per $1 million liable earnings increased during 2005-7 in comparison with 2002-4, particularly for new entitlement claims. However for both cases, the rate of claim costs reduced substantially - by over 50%. The rate of number of all new claims for the non-sample companies also increased similarly but there was a slight reduction in the rate of number of new entitlement claims. There were substantial reductions in claim costs by the non-sample companies but they were of smaller magnitude than for the Site Safe sample. It seems the

severity of injuries reduced in both cases but the reduction was higher for the Site Safe sample.

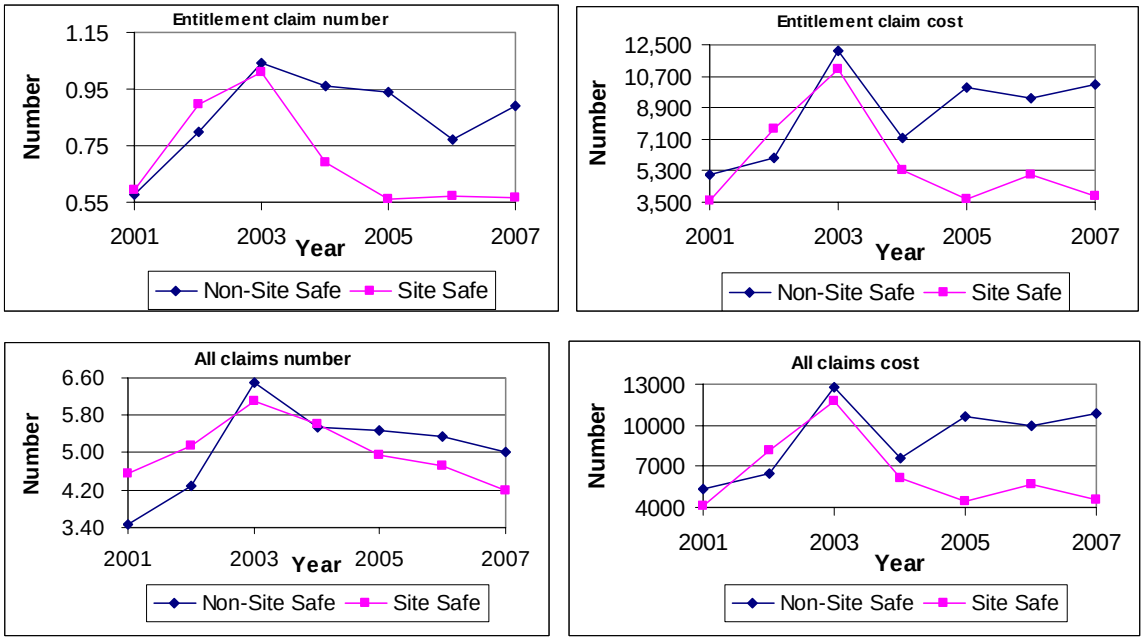
2.3.6 Level 4: Non residential building construction

Of all the ANZSIC level four codes for which data was available, non residential building construction has the highest number of companies in the Site Safe sample. The number of companies varied between 49 and 65 during the period of analysis. Given that this industry accounts for the largest share of the Site Safe sample (at ANZSIC level four), we have undertaken a more detailed trend analysis – see Figure 2.

The Site Safe sample improved their rates of claims substantially during 2005-7 in comparison with 2002-4 levels. The performance for the Site Safe sample was considerably better than for the non-sample companies. Indeed, between these two periods the rates of new claim costs *increased* for the non-sample companies by about 20%, when for the Site Safe sample the rates reduced by over 40% (Table 2).

The downward trend in new entitlement claims and claim costs started after 2003 for both the Site Safe sample and the non-sample companies. The trend has been steeper for the Site Safe sample. For all new claims also the trend was steeper for the Site Safe sample (Figure 2). For the non-sample companies while there is a declining trend in the rates for number of claims, the rates for claim costs show an increasing trend during the last four years, resulting in a 20% increase in the rates over the period 2005-7 relative to 2002-4 (Table 2).

Figure 2 New claim numbers and costs per $1 million liable earnings – non residential building construction



Source: ACC/NZIER

2.3.7 Level 4: Air conditioning and heating services

The number of companies in the Site Safe sample is small in air conditioning and heating services; the number varies between only 9 and 12.

While the non-sample companies show substantial improvement in claim statistics, the Site Safe sample shows the opposite. The number of claims and cost rates per $1 million liable earnings actually increased for the Site Safe sample during the 2005-7 period. There was a considerable increase in new entitlement claim costs by the Site Safe sample in the year ending March 2006. The claim number was particularly high in the following year.

2.3.8 Level 4: Security and alarm system installation

The number of companies in the Site Safe sample varied only between 2 and 3 in this industry during the period from April 2001 to March 2007. Thus the sample in this industry is very small.

The rate of new entitlement claim numbers increased for both the Site Safe sample and the non-sample companies but reduced in other areas. The rates of reduction were higher for the non-sample companies except for the number of all new claims.

The actual rates were much higher for the Site Safe sample in both 2002-4 and 2005-7 periods than for the non-sample companies.

2.3.9 Level 4: Painting and decorating services

The number of companies in the Site Safe sample has been reasonable in this sector – it is next to non residential building construction - varying between 15 and 21. The rates for number of claims increased for the Site Safe sample during 2005-7 but the rates for costs reduced substantially. The rates reduced for the non-sample companies in all cases. However, the reductions were lower than for the Site Safe sample for claim costs.

2.4 Life time claim costs

Given the heterogeneity in salary distribution of employees, the normalisation process using liable earnings has its limitations. Nevertheless, by comparing the variation in rates between two three year time periods, we assume that the impact of differences in salary distribution between the Site Safe sample and the non-sample companies will be reduced at least to a certain extent.

Since the heterogeneity is likely to be the least at the fourth level of ANZSIC classification, we have carried out our analysis at this level. However, this degree of disaggregation also has a limitation in that the number of companies in the Site Safe sample in some categories is very small and hence there is a higher possibility of stochastic variation even when we look at costs over three year periods.

A reduction in the number of claims not only saves ACC costs in that year but also costs associated with injuries over time. So if Site Safe has an impact on the risk of injuries at workplaces, then there will be savings to ACC in terms of life time costs to ACC of those injuries for which claims are made to ACC and accepted by them.

In other studies which we have conducted using ACC data (NZIER forthcoming), ACC estimates the life time claim costs for all workplace injuries. These estimates indicate that the *life time* claim costs to ACC are about 2.2 times the cost of *new* entitlement claims during a year. This may of course vary between company groups but no information on this is available. So we assume the same rate. Since we are comparing groups at level four ANZSIC, even if the multiplier is different from 2.2, the direction of change should be the same. The actual savings can of course be different from those estimated.

We have undertaken the analysis for the Site Safe sample in all industries for which information at ANZSIC level four was available i.e:

- Structural steel fabricating
- Non residential building construction
- Air conditioning and heating services
- Security and alarm system installation
- Painting and decorating services

With the exception of non residential building construction, the number of firms in the Site Safe sample is small. It is particularly small for security and alarm system installation.

The process for our analysis of savings in life time costs is explained mathematically in Appendix A.

2.4.1 Structural steel fabricating

Only a few structural and steel fabricating firms are in the Site Safe sample, varying between 7 and 11 in a year. The rate of new entitlement claim costs per $1 million liable earnings by companies in the Site Safe sample reduced in the 2005-7 period by about 54% from the 2002-4 level, both expressed at 2007 prices. During the same period this reduced by 41% for the non-sample companies.

The 54% reduction in the rate of new entitlement claim costs indicates that there is additional savings of $329,000 per year in terms of life time costs to ACC. Considering that some of the benefits would have been achieved through other interventions as shown in the improvement for the non-sample companies, we estimated the savings if the Site Safe sample made a similar improvement as the non-sample companies in the absence of Site Safe's involvement. In that case the savings in life time costs would be about $80,000 from each year's improvement. Thus Site Safe's contribution could be in the range of $80,000-$329,000 from each year's improvement.

Table 3 Life time cost savings in structural steel fabricating
(Site Safe sample)

Period	New entitlement cost ($M)	Liable earnings ($ M)	Rate	Estimate of new entitlement cost if the rate remained the same as in 2002-4 ($M)	Difference ($M)	Estimate of life time cost saved per year ($ M)
2002-4	0.695	37.950	0.018325			
2005-7	0.379	45.212	0.008389	0.829	0.449	0.329
If the rate changed in the same manner as in non-sample companies						
2005-7			0.010811	0.489	0.110	0.080

Notes: (1) All costs are expressed at 2007 prices.
Source: ACC/NZIER

2.4.2 Non residential building construction

From the available statistics we find that non residential construction has the highest number of companies in the Site Safe sample. The number of companies varied between 49 and 65 during the period of analysis 2002-2007, with liable earnings of about $134 million in 2007.

The rate of new entitlement claim costs per $1 million liable earnings by the Site Safe sample reduced in the 2005-7 period by 47% from the 2002-4 level, both expressed at 2007 prices. During the same period this increased by 20% for the non-sample companies, as shown in Table 2. Table 4 shows that the Site Safe sample might have contributed to savings of $1-$1.5 million per year in claim cost savings to ACC.

Table 4 Life time cost savings in non residential building construction
(Site Safe sample)

Period	New entitlement cost ($M)	Liable earnings ($ M)	Rate	Estimate of new entitlement cost if the rate remained the same as in 2002-4 ($M)	Difference ($M)	Estimate of life time cost saved per year ($ M)
2002-4	1.994	250.687	0.0079528			
2005-7	1.575	374.692	0.0042037	2.980	1.405	1.030
If the rate changed in the same manner as in non-sample companies						
2005-7			0.009564	3.584	2.009	1.473

Notes: (1) All costs are expressed at 2007 prices.
Source: ACC/NZIER

2.4.3 Air conditioning and heating services

In this case as shown in Table 5, the ACC claim data do not show any improvement in claim costs. In fact the claim rate *increased* for the Site Safe sample, while it reduced for the non-sample companies. However, the level of change is small due primarily to the small number of companies in the Site Safe sample in this industry.

Table 5 Life time cost savings in air conditioning and heating services
(Site Safe sample)

Period	New entitlement cost ($M)	Liable earnings ($ M)	Rate	Estimate of new entitlement cost if the rate remained the same as in 2002-4 ($M)	Difference ($M)	Estimate of life time cost saved per year ($ M)
2002-4	0.097	63.615	0.001532			
2005-7	0.143	67.275	0.001879	0.117	- 0.026	- 0.019
If the rate changed in the same manner as in non-sample companies						
2005-7			0.000905	0.069	- 0.074	- 0.055

Notes: (1) All costs are expressed at 2007 prices.
Source: ACC/NZIER

2.4.4 Security and alarm system installation

The claim rate improved only slightly for the Site Safe sample. More substantial improvement occurred in the non-sample companies. The claim amount per year is low for this sector. Therefore, the overall effect is also low. As shown in Table 6, if in 2005-7 the claim rate remained the same as in 2002-4, the entitlement claim cost would be higher by $26,000. However, if the improvement was the same as in the non-sample companies, the claim cost would be lower by about $27,000.

Table 6 Life time cost savings in security and alarm system installation
(Site Safe sample)

Period	New entitlement cost ($M)	Liable earnings ($ M)	Rate	Estimate of new entitlement cost if the rate remained the same as in 2002-4 ($M)	Difference ($M)	Estimate of life time cost saved per year ($ M)
2002-4	0.271	29.518	0.0091642			
2005-7	0.248	29.850	0.008305	0.274	0.026	0.019
If the rate changed in the same manner as in non-sample companies						
2005-7			0.007407	0.221	- 0.027	- 0.020

Notes: (1) All costs are expressed at 2007 prices.
Source: ACC/NZIER

This shows there is no obvious indication that Site Safe helped improve safety in this particular industry.

2.4.5 Painting and decorating services

Amongst the trade services to construction only painting and decorating services have a reasonable number of companies in the Site Safe sample. The yearly variation in the Site Safe sample size is between 15 and 21 during the 2002-07 period.

In this industry, the new entitlement claim costs rate reduced in 2005-7 by about 50% from the 2002-4 level for the Site Safe sample. During the same time, the rate for the non-sample companies reduced by 22%.

A similar analysis as in the previous cases shows that the savings in life time costs in this industry were between $154,000 and $276,000, due to Site Safe's services if there was no other intervention for the Site Safe sample (Table 7).

Table 7 Life time cost savings in painting and decorating services
(Site Safe sample)

Period	New entitlement cost ($M)	Liable earnings ($ M)	Rate	Estimate of new entitlement cost if the rate remained the same as in 2002-4 ($M)	Difference ($M)	Estimate of life time cost saved per year ($ M)
2002-4	0.554	38.433	0.0144266			
2005-7	0.376	52.154	0.0072086	0.752	0.376	0.276
If the rate changed in the same manner as in non-sample companies						
2005-7			0.0112453	0.586	0.211	0.154

Notes: (1) All costs are expressed at 2007 prices.
Source: ACC/NZIER

2.4.6 Summary

The above analysis shows that at the fourth ANZSIC code level, substantial improvement has been achieved in the non residential building construction industry in terms of lifetime cost saving per year to ACC in relation to the Site Safe sample. This amounts to savings of over $1 million to ACC from every year's reduction in claims. Some savings are also observed in painting and decorating services and in structural steel fabricating services. However, no improvement (and in some cases a slight deterioration) is noticed in the other two industries, viz., air conditioning and heating services and security and alarm system installation, where the Site Safe sample is small.

2.5 Savings in social costs

The savings in social costs have been estimated for non residential building construction only. Because of the complexity of normalising claim statistics for different firms, we place more emphasis on analysis at ANZSIC level four. Among the five industries for which we have data at ANZSIC level four, we have conducted the social cost analysis solely for non residential building construction. This is due to the relatively larger Site Safe sample in this industry compared with that in the other four industries, as discussed earlier.

Social cost is the total of all direct and indirect costs (tangible and intangible) to society. In this case it is the total of all costs related to injuries and deaths at non residential building construction workplaces. From an earlier study (NZIER forthcoming), we find that social cost of all injuries and deaths (including estimates of those that occurred later) in the construction industry *in general* is about $66,800 at June 2006 prices per new claim during a year. We have used this value to estimate the social costs.

2.5.1 Non residential building construction

As in estimating the life time cost savings, social costs are first estimated for each period. Then we estimate the social cost in 2005-7 period if the rate of social cost per dollar liable earnings remained the same as in 2002-04. The difference indicates the savings in social costs. If nothing other than Site Safe's involvement contributed to this safety improvement for the Site Safe sample, then this indicates the value saved as a result of Site Safe.

Table 8 Social cost savings in non residential building construction
(Site Safe sample)

Period	No. of new claims	Estimate of social cost ($M)	Liable earnings ($ M)	Rate	Estimate of social cost if the rate remained the same as in 2002-4 ($M)	Difference ($M)	Estimate of social cost saved per year ($ M)
Site Safe							
2002-4	1,411	94.255	250.687	0.3760			
2005-7	1,724	115.163	374.692	0.3074	140.879	25.715	8.6
If the rate changed in the same manner as in non-sample companies							
2005-7				0.3714	139.165	24.001	8.0

Notes: (1) All costs are expressed at 2007 prices.

Source: ACC/NZIER

As noted earlier, many factors other than Site Safe are likely to have contributed to improved claim rates in the Site Safe sample. So we looked at what happened in the non-sample companies for the same ANZSIC group for comparison purposes. Here also, there was an improvement in the rate of social cost per liable earning. We then estimated the social cost if the Site Safe sample of companies improved their rate of social cost per liable earning by the same proportion as the non-sample companies. It is explained mathematically in Appendix B.

The results shown in Table 8 indicate that the reduction in claim rates for Site Safe firms resulted in about $8.6 million per year saving in social costs. However, there were improvements in the non-sample companies as well. If the Site Safe sample had the same rate of improvement then their social cost saving would have been about $8.0 million. Thus Site Safe's involvement appears to have saved about $8.0-8.6 million in social costs per year in relation to the Site Safe sample.

3. Context – international patterns and trends in injury rates

In this section we examine international patterns and trends in work-related injury rates (fatal and non-fatal), based on a brief literature review. We start off considering patterns and trends by broad industry grouping (construction and other), and then drill down into more detail by sub-industry within the construction industry.

The purpose is to provide some context for the Site Safe-specific analysis. Companies utilising Site Safe's services operate in various sub-industries within construction, and in a range of other industries in New Zealand. If we can understand international injury rate trends in construction at a sub-industry level, and the drivers for those trends, we can better interpret the impact of Site Safe on injury rate trends in New Zealand. For example, even if injury rates are falling in sub-industries within which Site Safe operates, this may be attributable to a range of factors other than Site Safe.

But note that there are challenges in conducting inter-country comparisons of injury rates, due to differences in the scope and methodology of data collection. And for each country there may be factors which limit the relevance of comparisons of its injury rate trends with those in New Zealand. Probably of most importance here are differences in construction methods, legal settings and institutions, and compensation and insurance schemes for occupational injuries. Some of these differences are discussed below.

3.1 Injury rate patterns by country and broad industry

3.1.1 Fatal injuries

A recent New Zealand study (NOHSAC 2004) compared work-related fatal injuries across a range of industries in New Zealand, the United States and Australia. Data from the three countries were standardised as much as possible, in particular to adjust for industry distribution. **Unadjusted injury rates were highest in New Zealand,** but after adjustment for industry, New Zealand rates were 10% to 15% higher than the other two countries. So **New Zealand has an "industry mix" weighted towards relatively dangerous industries.**

The construction industry has a poor record for fatal occupational injuries. In a comparison of fatality incidence rates in ten developed countries (including New Zealand) over the period 1998-99 to 2000-01 conducted by NOHSC in Australia (2004), construction ranked between first and fifth out of 13 broad industry groupings, with a ranking of "first" indicating that the industry had the highest incidence rate in that country. **Whilst New Zealand's performance was poor overall**, having the highest standardised (i.e. after adjustment for industry) incidence rate among the ten countries, **it appeared in around the middle of the rankings for construction.**

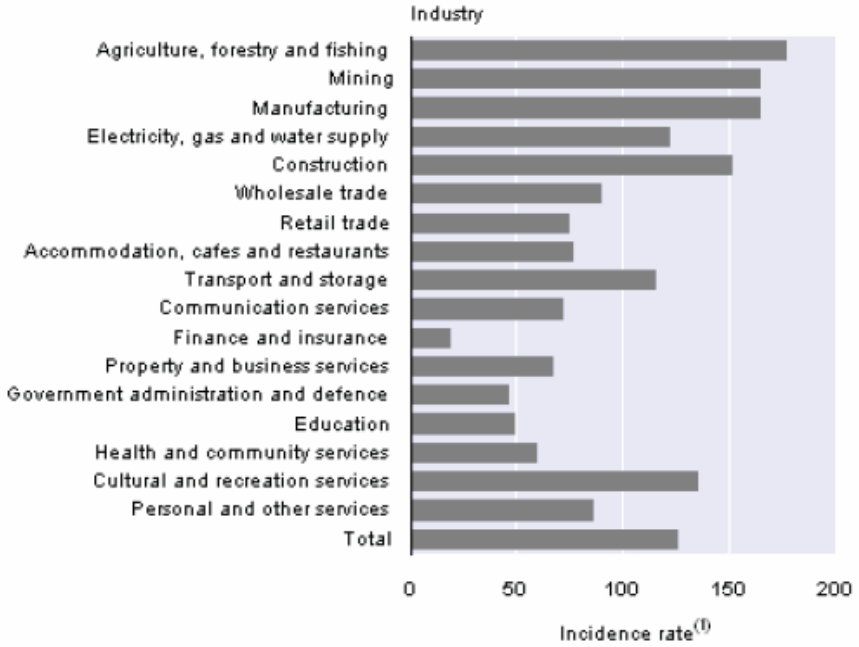
3.1.2 Non-fatal injuries

In a review of international literature relating to injury prevention in the construction industry, Van der Molen et al (2007) note that poor construction safety has been reported in many studies from around the world.

In New Zealand, recent data from Statistics New Zealand indicates that **the construction industry in New Zealand has the fourth highest incident rate of work-related injury claims out of 17 broad industry groupings** – see Figure 3. There was an average of 152 work-related injury claims per 1,000 full-time equivalent workers (FTEs) in 2006 in the construction industry, compared with 126 across *all* industries (Statistics New Zealand 2007).

Figure 3 New Zealand injury rates by industry

Claims per 1,000 full-time equivalent workers



(1) Claims per 1,000 full-time equivalent workers.

Source: Statistics New Zealand Injury Statistics 2006

3.2 Injury rate trends

In most developed countries, **work-related injury rates have been trending downwards** in recent years, both in construction (see Borooagh and Mangan 1998; HSE 2007b; Pollack and Chowdhury 2001; Welsch et al 2007) and across *all* industries (see Borooagh and Mangan 1998; HSE 2007a). However, some countries are seeing **injury rate trends starting to plateau** (see HSE 2007a), especially in relation to fatalities (Pollack and Chowdhury 2001; Welch et al 2007).

In New Zealand, injury rates in the construction industry slowly trended downwards over the period 2002 to 2005. This follows the general trend across *all* industries (Statistics New Zealand 2007).

3.3 Injury rate trends in construction sub-industries

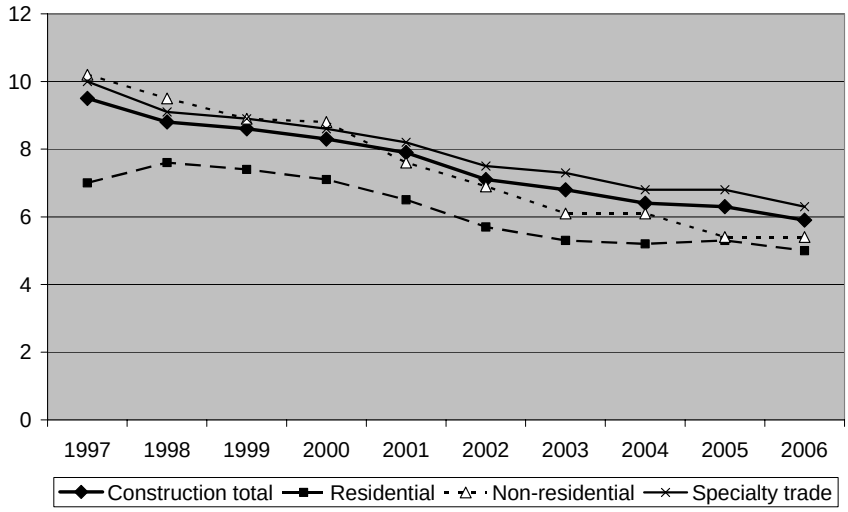
Figure 4 shows injury rate trends by construction sub-sector in the US (Bureau of Labor Statistics 2007).

Key points to note from the figure are as follows.

- Injury rates have been trending downwards for each of the sub-sectors over the period shown.
- **Injury rates have fallen most rapidly in non-residential construction.** At the start of the period, non-residential construction had a higher incidence rate than construction in total, but by the end it had a lower rate
- Residential construction had the lowest injury rates and experienced the smallest decline in rates over the period.

Figure 4 US construction injury rate trends by sub-industry

Incidence rate (per 100 full-time workers) of non-fatal occupational injuries and illnesses, 1997-2006



Source: U.S. Department of Labor, Bureau of Labor Statistics

Another US study (Pollack and Chowdhury 2001) examines injury rates in *occupations* within the US construction industry over the period 1992-98. The authors found that non-fatal injury and illness rates for labourers, ironworkers and roofers were consistently above the all-construction rates. The death rates for labourers, ironworkers, roofers, truck drivers and welders & cutters were consistently above the all-construction rates.

3.4 Causes of injury rate patterns and trends in construction

3.4.1 Types and causes of injuries

Haslam (2005) (cited in Van der Molen et al 2007) describes the elements of a typical construction project, and the potential causes of injuries for each element.

- *Worker and work team* - worker actions and behaviour, capabilities, communication, health, and available supervision
- *Workplace* - site conditions and layout, work environment, work scheduling, and housekeeping
- *Materials* - material suitability, usability, and condition
- *Equipment* - equipment suitability, usability, and condition
- *Organisation* - construction job design, project management, construction processes, safety culture, risk management, and productivity control.

In their review of international literature relating to injury prevention in the construction industry, Van der Molen et al (2007) note that the majority of construction **fatalities result from falls from heights and being struck by moving vehicles**. The majority of **non-fatal injuries in construction result from falls from heights and on the level, from slips and trips, and from being struck by a moving or falling object**.

In other studies we have conducted (NZIER forthcoming), ACC claim statistics in New Zealand also indicate falls from height (loss of balance or personal control) as the main cause of injuries in the construction industry, along with being struck by workplace property and lifting/carrying/strain.

In the US, Horwitz and McCall (2003) state that the reasons for the higher fatality rate of workers in the construction industry relative to workers in other industries include **frequent exposure to toxic agents,** dealing with **high-voltage industrial wiring and appliances**, working on places where **serious falls** are more likely, and involvement in duties which increase the risk of fatal encounters with **motor vehicles.**

As noted above, **specific occupations** within construction can be associated with higher injury rates than others. For example, Horwitz and McCall (2003) found that the high injury rate among insulation workers may be attributed to the fact that this occupational group experiences falls, as well as being at high risk of being struck by objects.

The same authors found **demographic factors** to be important factors explaining injury rates in the US construction industry.[10]

[10] More generally, injury rates vary by demographic group across a range of industries. Statistics New Zealand (2007) found that workers aged 65 years and over had a higher rate of work-related injury claims (across *all* industries) than any other age group

- Workers aged 35 years and younger and those aged 56-65 filed a disproportionately high number of injury claims.
- Workers with a job tenure of one year or less filed a disproportionately high number of injury claims.

Firm size is also important. Small construction establishments appear to suffer a disproportionate share of work-related deaths from injuries (Welch et al 2007).

Finally, **incentives** to improve safety (or *report* improved safety) are an important consideration, as noted by Welch et al (2007) - discussed further below.

3.4.2 Causes of downward trend in injury rates

In a study of workplace safety in the mining, manufacturing and construction industries in Queensland over the period 1983-93 (Borooagh and Mangan 1998), the authors conclude that a trend in each of the three industries towards lower injury rates was caused by the following.

- **Management becoming more safety-conscious** (recognising perhaps that a safer firm was also a more profitable firm).
- **Technological improvements** making machines safer to use.
- **Government policy,** including legislative measures and safety-awareness campaigns.
- **Reluctance by workers to claim compensation**, due to increasing job-insecurity over the period.

In the US, Conway and Svenson (1998) (cited in Pollack and Chowdhury 2001) attribute declining injury rates in construction to **workers' compensation reforms and an increasing awareness among workers of workplace hazards**.

Also in the US, Welch et al (2007) note that whilst non-fatal injury rates have declined steadily among construction workers over the last few decades, fatality rates have not. The authors note that these findings occur in the context of a business climate that rewards construction companies with injury rates below average, and a period when the safety agency reduced inspections for record-keeping violations and targeted inspections based on injury reporting. They suggest that these **incentives cause significant under-reporting** of occupational injuries in the US construction industry.

3.4.3 Effectiveness of interventions

In their assessment of the effectiveness of interventions, Van der Molen et al (2007) found **no evidence that regulation is effective** in preventing non-fatal and fatal injuries in the construction industry. They found **limited evidence showing that a multifaceted safety campaign** and a multifaceted drug-free workplace program can reduce non-fatal injuries in the construction industry.

3.5 Summary and interpretation

Construction is a physical activity, undertaken in a hazardous work environment. It is not surprising that injury rates are relatively high.

Both internationally and in New Zealand, injury rates in construction are falling, as they are across *all* industries. It is interesting to note that in the US, injury rates among construction sub-industries have fallen most rapidly in non-residential construction. However, it is difficult to know the underlying causes of these variations at a sub-industry level. Most of the information we have unearthed about causes of injuries is across construction as a whole, rather than at a sub-industry level.

Variations in injury rate trends at a sub-industry level is potentially important to Site Safe, as the "industry mix" for Site Safe's client base varies from that across construction as a whole. In particular, companies which use Site Safe's services are over-represented in non-residential building construction. If similar injury rate trends are occurring in New Zealand as in the US, Site Safe could be operating in the part of the construction sector where injury rates are dropping most rapidly. This in turn suggests that many factors other than Site Safe may cause injury rates to fall among companies using its services. This provides the rationale for our Site Safe-specific analysis in the pervious section being conducted at the most detailed industry level.

However, it is difficult to know the extent to which international comparisons are valid. Exposure-to-risk and incentives to improve safety vary markedly by country. This is reflected in significant variations in injury rates by country, with New Zealand performing relatively poorly, although better in construction than across all sectors. Much of the more detailed information picked up in our brief review is from studies conducted in the US, where the legal system in particular differs from that in New Zealand.

Incentives influence injury rate trends and reporting. In the New Zealand context, the law requires employers to provide work-related injury cover for all their employees via ACC; ACC levies are based on the industry classifications, with companies in high-risk industries paying higher levies. Therefore comapnies may be incentivised to classify themselves to a lower-risk industry than the one in which they in fact operate. Given the point made above that an analysis at a sub-industry level is important to Site Safe, any mis-classification could cause problems in our Site Safe-specific analysis.

4. Conclusion

If improved claim rates for the Site Safe sample (both between the two time periods 2002-4 and 2005-7, and compared with trend rates for the non-sample companies) are assumed to be solely attributable to Site Safe's involvement, then the analysis indicates substantial contribution by Site Safe in some industries, particularly in non residential building construction. In this industry, there were savings in life time costs of ACC claims of about $1 million per year in relation to the Site Safe sample. Also there was national benefit of about $8 million per year in terms of savings in social costs in relation to the Site Safe sample.

In other industries the savings (or otherwise) in lifetime costs were relatively small.

Appendix A Estimation of life time cost savings

Suppose β = the ratio between life time cost savings and new entitlement cost

E_i = New entitlement cost in period i for Site Safe firms at 2007 prices

NE_i = New entitlement cost in period i for non Site Safe firms

L_i = liable earnings of Site Safe firms in period i

NL_i = liable earnings of non Site Safe firms in period i

γE_i = Rate of new entitlement claim cost per liable earnings in period i by Site Safe firms = $\frac{E_i}{L_i}$

γNE_i = Rate of new entitlement claim cost per liable earnings in period i by non Site Safe firms = $\frac{NE_i}{NL_i}$

If Site Safe firms had the same risk in period 2 as in period 1, their entitlement cost would be = $\gamma E_1.L_2$. Therefore, savings in new entitlement cost in period 2 = E_2-$\gamma E_1.L_2$. The savings in life time cost = (E_2-$\gamma E_1.L_2$) β. This would be the savings in benefits if Site Safe firms did not have any intervention in period 2 other than Site Safe's involvement.

If on the other hand their risk change would be at the same rate as non Site Safe firms in the absence of Site Safe's involvement, then the following would apply.

Suppose $\theta = \frac{\gamma NE_2}{\gamma NE_1}$ = the ratio of rates of new entitlement claims for non Site Safe firms in periods 2 and 1.

If Site Safe firms had the same risk reduction rate as the non Site Safe firms in period 2, then their new entitlement cost would be $E_2^* = \theta.\gamma E_1.L_2$.

The savings in entitlement cost would be $E_2 - E_2^*$.

The savings in life time costs would be $(E_2 - E_2^*)\beta$.

Appendix B Estimation of social cost savings

Suppose

s = the social cost per new claim at June 2006 prices.

NS_i = Number of new claims in period i by Site Safe firms in a given group of ANZSIC codes.

SS_i = Social cost of Site Safe firm claims in period i

$= s.\ NS_i$

L_i = Liable earnings of all Site Safe firms

αS_i = Rate of social cost per liable earnings in period i by Site Safe firms

$$= \frac{SS_i}{L_i}$$

So in period 2 (2005-7) $SS_2 = sNS_2$

If the rate in period 2 was the same as in period 1, then social cost in period 2 would be $SS_2^* = \alpha S_1 . L_2$.

If in the absence of Site Safe's involvement the rate of social cost in period 2 would be the same as in period 1, then the gain due to Site Safe's involvement in period 2 is

$$GS_2 = SS_2^* - SS_2 .$$

There are other interventions and also, there might have been general improvement in safety in this area. In that case, the effect of these should be indicated in safety performance of non Site Safe firms.

Suppose

NnS_i = Number of new claims in period i by non Site Safe firms in a given group of ANZSIC codes.

NL_i = Liable earnings of all non Site Safe firms

αnS_i =Rate of social cost per liable earnings in period i by non Site Safe firms

$$= \frac{SnS_i}{NL_i}$$

The improvement in rate of social cost per liable earning = $\frac{\alpha n S_2}{\alpha n S_1}$

If safety improved in the same manner in Site Safe firms as in non Site Safe firms, then the rate in period 2 in Site Safe firms would be $\alpha S_1^* = \frac{\alpha n S_2}{\alpha n S_1} \alpha S_1$ and the social cost would be $SS_2^{**} = \alpha S_1^* L_2$. The savings would be $GS_2^* = SS_2^{**} - SS_2$.

GS_2 and GS_2^* give a range of possible contribution of Site Safe.

Appendix C About Site Safe

The following narrative has been provided by Site Safe.

Historically New Zealand's construction industry has not had a good safety record. As a consequence of innocent workers injuring themselves due to poor site safety practices, Government, ACC and the construction industry decided that workplace safety had to be improved substantially.

Site Safe was launched in 1999 with a principal objective of preventing harm to employees at work, by implementing a four step plan for site safety:

- Promote best practice and a safety culture in industry
- Provide health and safety training nationwide
- Provide industry leadership in health and safety
- Work with Government to create incentives for industry compliance.

There are a range of sector specific induction Passport courses introduced to ensure that everyone on a construction site has a basic understanding of the health and safety hazards that they are likely to face, in their industry, so that no-one is endangering themselves or their workmates. Passport courses are therefore designed as a 4 hour course aiming to uplift employee awareness on the Health and Safety issues on the work site and also create a consistent standard for safety practices across the industry. Completion of a Passport course has become a mandatory requirement for all employees before being admitted on most commercial sites in New Zealand.

Sector specific Passports include:

- Building Construction Passport
- Civil Passport
- Residential Passport
- Maintenance Passport
- Electrical Passport

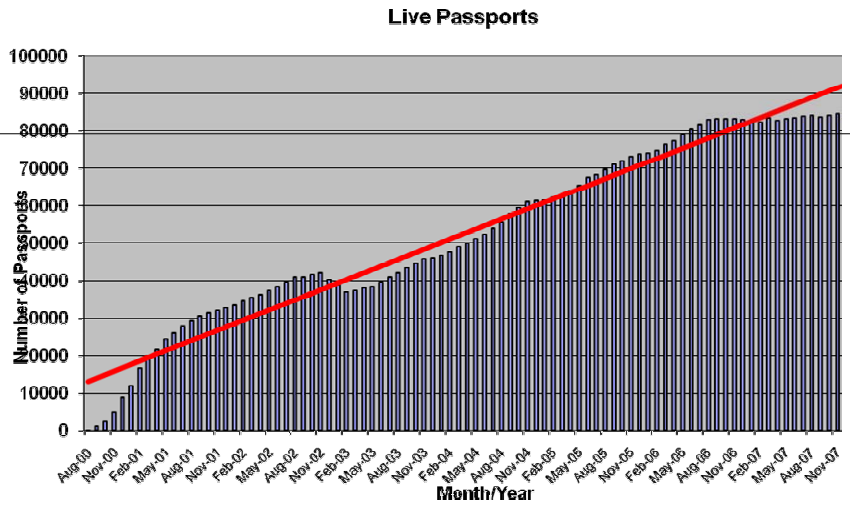
Site Safe also offers a range of one and two-day higher level training courses which target supervisors and senior managers and those who need a more in depth knowledge of construction health and safety. The two-day programme is like nothing else currently on the market. It has been specifically designed in collaboration with the industry and complements the Passport induction including:

- The Advanced Passport – Workplace Safety Course
- Supervisor Gold Card Course
- Gold Card Renewal Course
- Working Safety at Height

- Leadership Course
- Construction Management Course
- Health & Representative Training (DoL Approved)

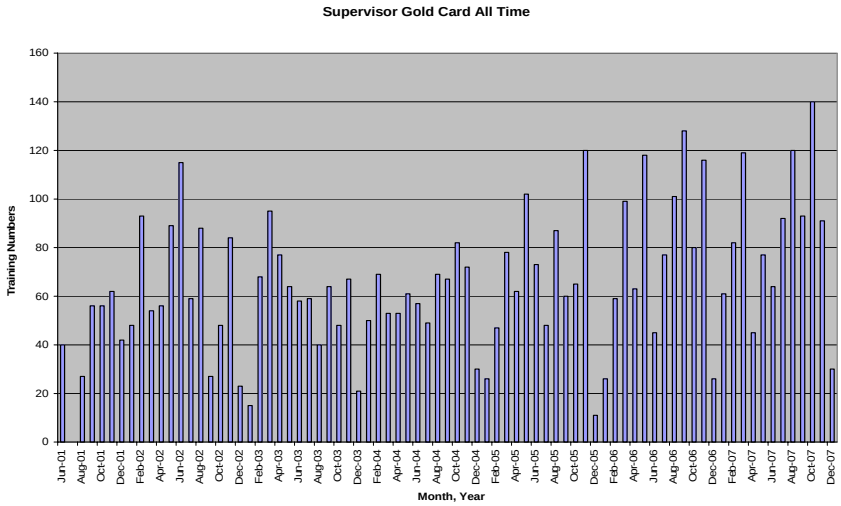
Site Safe has a 40 Credit "Certificate in Construction Site Safety" with all bar the Passport courses attracting Certificate Credits – on achievement of 40 Credits a Trainee can graduate with the Certificate in Construction Site Safety. The diagrams below describes the total number of employees trained by Site Safe on Passport and Supervisor courses.

Figure 5 Passports



Source: Site Safe

Figure 6 Gold Card



Source: Site Safe

In conjunction with these Training Programs, Site Safe also offers a wide variety of Consultancy Services on health and safety related functions such as:

- Customised Safety Training Courses
- Workplace Audits
- Project Safety Management
- ACC Health and Safety Compliance Programmes
- Pre-ACC Self Audit Assistance
- Accident Investigation
- Manufacturing Plant and Office Layout
- Manpower and Equipment Evaluations
- Noise and Lighting Assessments
- Engineered Heavy Lifts
- Rehabilitation Policy and Plans
- Risk Management

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