Fire Researc
Reportt

An Economic Assessment of Industrial fires in New Zealand

BERL

January 2002

Abstract

The objective of this study is to make an assessment of the economic impact of industrial fires in New Zealand.

This assessment is made using a common applied economic research technique known as an Economic Impact Assessment (EIA) to measure the direct and indirect economic costs associated with industrial fires. The EIA allows the indirect (supply-chain) impact of changes in business activity due to industrial fire incidents to be measured in terms of changes in economic output and employment.

The three main production sectors had very similar total direct costs of industrial fires in 2000:

The primary production sector consisting of agriculture, fishing, and mining recorded a total cost $18.0 million;

The secondary production sector consisting of processing and manufacturing recorded a total cost of $16.7 million; and

Mark Goodchild, Ganesh Nana, Kel Sanderson

New Zealand Fire Service Commission Research Report Number 28

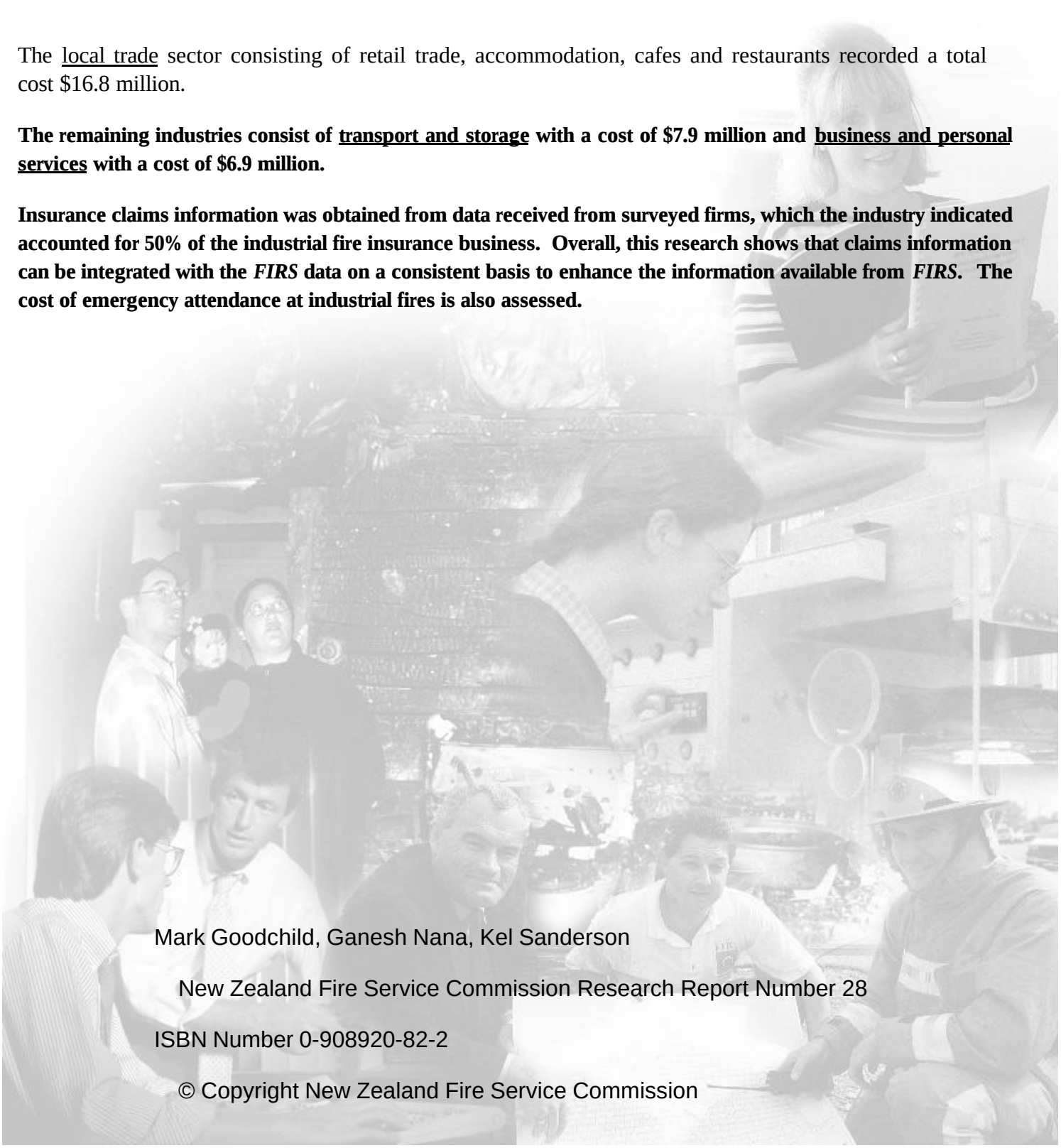
ISBN Number 0-908920-82-2

Fire Researc Reportt

The local trade sector consisting of retail trade, accommodation, cafes and restaurants recorded a total cost $16.8 million.

The remaining industries consist of transport and storage with a cost of $7.9 million and business and personal services with a cost of $6.9 million.

Insurance claims information was obtained from data received from surveyed firms, which the industry indicated accounted for 50% of the industrial fire insurance business. Overall, this research shows that claims information can be integrated with the *FIRS* data on a consistent basis to enhance the information available from *FIRS*. The cost of emergency attendance at industrial fires is also assessed.



Mark Goodchild, Ganesh Nana, Kel Sanderson

New Zealand Fire Service Commission Research Report Number 28

ISBN Number 0-908920-82-2

Business and Economic

Research Limited

Report to:
The New Zealand Fire Service Commission

AN ECONOMIC ASSESSMENT OF INDUSTRIAL FIRES IN NEW ZEALAND

BERL Project #4067

Prepared by

Mark Goodchild
Ganesh Nana
Kel Sanderson

January 2002

Business and Economic Research Ltd
Level 5, 108 The Terrace
PO Box 10-277
Wellington
New Zealand
phone: +64 4 470 5550
fax: +64 4 473 3276
web-site: www.berl.co.nz
e-mail: innovate@berl.co.nz

CONTENTS

1 Summary 3

1.1 Economic and Social Costs of Industrial Fires in 2000 3

1.2 Industries with Highest Direct Costs of Fires 4

1.3 Regions with High Incidence of Industrial Fires 4

1.4 Using Claims Data to Enhance FIRS Information 5

1.5 Cost of Emergency Response to Industrial Fires 6

2 Definitions and Scope 8

2.1 Fire Incidents 8

2.2 Industry Groups 8

2.3 Regional Groups 8

3 Data Sources 9

3.1 Fire Incident Reporting System 9

3.2 Rawlinsons NZ Construction Handbook 9

3.3 Insurance Claims Database 9

3.4 1996 Intra-Industry (Input-Output) Study 9

3.5 Social Cost of Injuries 9

4 All Industrial Fire Incidents 10

5 Industrial Structure Fires 13

5.1 Incidence of Structure Fires by Industry 13

5.2 Incidence of Structure Fires by Region 14

5.3 Prevalence of Industrial Structure Fires 14

5.4 Area of Industrial Property Lost 17

5.5 Extent of Property Lost 18

6 Direct Economic Impacts 20

6.1 Value of Building Property Lost 20

6.2 Industrial Fire Claims 22

6.3 Consistency of Estimated Claims and FIRS Property Loss 24

6.4 Industry Pattern of Claims 27

7 Cost of Emergency Response Services 29

7.1 Identification of Output Costs 29

7.2 Allocation of Emergency Response Costs 29

8 Indirect Economic Impacts 33

8.1 Impact on Economic Activity 33

8.2 Impact on Employment 35

9 Social Cost of Fire Injuries 37

10 Total Economic Impacts 40

11 Where to From Here 42

1 SUMMARY

This study was undertaken on behalf of the *New Zealand Fire Service Commission* with funding from the Contestable Research Fund. The objective of this study is to make an assessment of the economic impact of industrial fires in New Zealand.

This assessment is made using a common applied economic research technique known as an Economic Impact Assessment (EIA) to measure the direct and indirect economic costs associated with industrial fires. The EIA allows the indirect (supply-chain) impact of changes in business activity due to industrial fire incidents to be measured in terms of changes in economic output and employment.

1.1 Economic and Social Costs of Industrial Fires in 2000

The finding of the Economic Impact Assessment is that the total economic and social cost of industrial fires in New Zealand in 2000 was approximately $86 million. This is a substantial figure, although perhaps not as large as may have been expected. On the one hand, the moderate level of cost from industrial fires could be thought to reflect a fairly effective fire prevention and control service, but on the other hand these costs are substantial enough at least in some industries to justify further attempts to reduce them.

The total direct economic costs to the businesses affected was $44 million and the Fire Service cost of operational readiness and response for industrial fires was $23 million, giving total direct economic costs of $67 million. A relatively small proportion of this direct cost (about $8 million) was from business interruption claims due to fire damage and thus, the effects on supplying industries was also estimated to be relatively small. This indirect economic cost was estimated at $8.5 million while the indirect effect of reduced consumption because of reduced incomes was estimated at just $2.1 million. The total impact upon employment including direct, indirect and induced linkages was estimated at 209 Full Time Equivalent jobs in 2000.

The only social costs measured in this study were from injuries and fatalities associated with industrial fires. The monetised value of these costs was estimated at $8.5 million in 2000. However, there could be some significant social and community costs in the case of substantial industry fires in small communities.

In extreme cases, such fires can cause significant local industries to close or to relocate outside of the community and therefore, to have significant local social and community impacts. Given the wide implications for such fires, the assessment or interpretation of their impacts would need to be made on a case study basis.

1.2 Industries with Highest Direct Costs of Fires

The three main production sectors had very similar total direct costs of industrial fires in 2000:

The primary production sector consisting of agriculture, fishing, and mining recorded a total cost $18.0 million;

The secondary production sector consisting of processing and manufacturing recorded a total cost of $16.7 million; and

The local trade sector consisting of retail trade, accommodation, cafes and restaurants recorded a total cost $16.8 million.

The remaining industries consist of transport and storage with a cost of $7.9 million and business and personal services with a cost of $6.9 million.

The industries within each group or sector showed a wide range of costs. The largest industries consist of agriculture ($17m), accommodation and cafes ($6.8m), storage and wholesaling ($6.7m), textile, clothing, and footwear manufacturing ($5.8m), business and financial services ($5.8m), personal and household retailing ($5.6m), food retailing ($2.9m) and wood and paper processing and manufacturing ($2.7m).

Food, beverages and tobacco, which is the large manufacturing group in New Zealand, had total direct fire costs of only $1.5 million.

Ten of the twenty-four industries had direct costs of less than $1 million in 2000, and as such accounted for a total of just $3.6 million cost or 5.6% of the total fire cost.

1.3 Regions with High Incidence of Industrial Fires

The main basis for estimating the direct costs of industrial fires came from the insurance claims information from the major fire and general insurance companies. This data was not available by region. However, the regional distribution of the incidence of industrial fires is available from the *FIRS* database, and this gives an interesting pattern. The fire regions with the highest levels of economic activity generally had the highest number of industrial fire incidents. Over recent years Auckland has about 800 incidents per annum, Transalpine (Canterbury/West Coast) about 600; Bay-Waikato about 500; and Arapawa (Wellington/ Top of the South) about 500.

Of these total industry fire incidents, the structure fire incidents had a somewhat similar pattern with Auckland 320, Bay-Waikato 210, Arapawa 180, and Transalpine 160 per annum. The incidence of these structure fires is analysed by industry and by region in this report with the finding that an industry with a high fire incidence tends to be high

across all regions, but there are some exceptions which indicate possible opportunities for improved performances.

1.4 Using Claims Data to Enhance FIRS Information

The *FIRS* database is a comprehensive record of fire and other emergency incidents in New Zealand, and as such it enables data sets to be compiled on a range of information. These include detailed classification of incidents to sort for fires, and specifically for industry fires. These fires are further sorted to find industrial structure fires and non-structure fires. These fires can then be sorted by specific industry, and for the eight fire regions. For structure fires, the data enables an estimation of the extent of the building property loss in each fire.

The *FIRS* database can also be manipulated to indicate the total number of appliances attending each fire, and the time spent, which can indicate the relative cost of attending different types of fires, and fires for different industries.

The other main information obtained from *FIRS* in this study was the number of persons injured or deceased at each fire and this enables estimation of some of the social costs of industrial fires.

The *FIRS* database **does not** provide information which can be used to infer estimates of business/industry costs of fires (other than costs of building property losses). For this reason this research surveyed the insurance claims information from the major fire and general insurance companies. This information was sorted for the same industry classifications as the *FIRS* data had been sorted into. For each fire, the claims data showed the dollar value of the claim for material damage and business interruption.

Material damage claims include the building property damage as estimated based on the *FIRS* data, as well as the cost of damage to equipment and stocks of goods and supplies. The business interruption claims indicates the level of economic activity lost directly as a result of the fire incident and thus, allows estimation of the indirect economic effects of the fires.

The claims information was from data received from surveyed firms, which the industry indicated accounted for 50% of the industrial fire insurance business. Comparison with other industry figures indicated this as a reasonable order-of-magnitude estimate.

More specific verification of this estimation was obtained through the value of building property losses as calculated from *FIRS* and through the value material damage from the insurance company survey. The estimates from each source (*FIRS* and insurance claims) were compared for each of the twenty-four industries separately. It was found that there were variances in the relationship between the two estimates, but that these variances were generally as to be expected according to the nature of activities in each industry.

Food, beverage and tobacco manufacturing was the main industry that showed a significant and unexpected variance between the *FIRS* and claims databases. In this case, the value of claims was significantly less than the building losses estimated from *FIRS*. It is quite probable that the large insurance company, which could not supply data within the timeframe of this research, does in fact insure a disproportionately large share of this industry. If that is the case, then the economic direct and indirect cost information derived for this industry would be an under-estimate.

Overall, however, this research shows that claims information can be integrated with the *FIRS* data on a consistent basis to enhance the information available from *FIRS*.

1.5 Cost of Emergency Response to Industrial Fires

The net operational expenditure on Fire Fighting and Other Fires Service Operations as recorded in the NZ Fire Service Commission's Annual Report was nearly $172 million in 2000. The *FIRS* data was used to obtain estimates of the relative amount of resource (measured as 'appliance-hours') applied to different types of incidents, including industrial fire incidents in 2000. The $172 million expenditure was then allocated to the incidents according to the relative quantum of resource used by each type of incident including industrial fires.

The relatively minor place of industrial fires in the total use of Fire Service resources is indicated by the following summary of the composition of 59,346 incidents recorded on the *FIRS* database for 2000.

Incidents in 2000	**Number**	**% of Total**
Total incidents	59,346	100%
of which:		
False alarms & good intent calls	24,372	41%
Active incidents	34,974	59%
of which:		
Non-fire incidents	14,915	25%
Fire incidents	20,059	34%
of which:		
Industrial fire incidents	**2,719**	**5%**

False alarms and good intent calls are not identified as to whether they are related to fire, industrial fires or non-fire incidents and therefore, the cost of the resource applied to false alarms and good intent calls is allocated pro rata to the other types of incidents including industrial fires. The implication is that if the false alarms and good intent calls could be significantly reduced (for example by improvement to reliability of automatic alarm systems) then the load carried by the active incidents, and including the industrial fires would be substantially reduced.

In terms of fire incidents the industrial fires comprise 13.6% of all fire incidents, and in our analysis of the appliance hours to fires we found that 21% of the resource applied to fires was applied to industrial fires. This indicates that an industrial fire uses about 50% more resource than all fires use on average.

Looking in more detail at the resources applied to fire fighting, we found that industrial structure fires on average required 4.1 appliances per incident, and non-structure fires required only 2.1 appliances per incident on average.

When the $172 million net expenditure was allocated according to the relative appliance hours used on each type of incident, it was found that industrial structure fires used $13.27 million worth of appliance hours in 2000. There were 1,100 industrial structure fires in 2000, and so this analysis would imply, incidentally that the average output cost per industrial structure fire incident was approximately $12,000 per incident in 2000.

2 DEFINITIONS AND SCOPE

This section defines the scope of this study and outlines the main areas of investigation.

2.1 Fire Incidents

This study is investigates the impact of fire incidents on industry and therefore excludes fire incidents that cause damage to residential buildings or other personal property such as motor vehicles. While this study investigates all types of industrial fires, much of the studies focus is upon fires that cause damage to structures, as these type of fires provide an intuitive link between physical damage and the economic cost associated with these damages through the replacement value of these buildings. Industrial structure fires are a subset of all industrial fires, which includes a number of other subsets such as mobile property, vegetation and hazardous substance fires.

The FIRS data for the last five years suggests that there has been a reasonably consistent number of about 1,200 industrial structure fires per annum. The FIRS data also records a further 2,200 industrial fires, consisting of mostly vegetation and miscellaneous fires, which brings the total number of industrial fires to about 3,400 per annum. Note that all industrial fires are assessed in this study, as they are included in the insurance industry claims data.

2.2 Industry Groups

This study integrates the unit records from a number of databases so that they constitute a common industry classification thus, allowing for the relationship between industrial fires and upstream economic impacts to be assessed. In essence, this required the unit records in the FIRS database to be matched to the corresponding Australia New Zealand Standard Industry Classification (ANZSIC) codes. This process lead to the design of 24 industries, with some of these being an amalgamation of a number of ANZSIC codes to ensure consistency between the two data sets. For example, the storage and wholesaling industry group consists of three ANZSIC codes - storage services (I67), basic material wholesaling (F45) and personal and household goods wholesaling (F47). A number of fire incidents have also been excluded for the purposes of this study. These exclusions relate to fires that affect ‘non-commercial’ activities such as government and other community services. Fires that occur in public car parks have also been excluded on the assumption that these incidents more correctly affect households as opposed to industry.

2.3 Regional Groups

The FIRS database provides data on incidents by eight fire regions. These regions have been adopted in this assessment.

3 DATA SOURCES

This study uses a number of different data sources to generate estimates of the economic costs of industrial fires. These data sources are discussed in this section with more detail being available in the technical appendix.

3.1 Fire Incident Reporting System

The FIRS database provides detailed information of emergency incidents as recorded by attending fire officers. The information retrieved from the FIRS database is described in the technical appendix. The FIRS database provided a complete set of unit records for 1999 to 2000 and a partial set of unit records for 1996 to 1998. The FIRS database from 1996 to 1998 does not include an estimate of the percent of property saved and therefore the area of property lost cannot be generated for these years.

3.2 Rawlinsons NZ Construction Handbook

This database provides an estimate of the average per metre construction cost of a range of commercial buildings. These costs represent the average cost of building the structure of a building excluding other costs such as land, chattels, and equipment. The core data from the Rawlinsons New Zealand Construction Handbook (2001) was used to estimate the per metre construction costs for each of the industries in this study.

3.3 Insurance Claims Database

This database contains information supplied by five of the major insurance companies operating in New Zealand's commercial insurance market. The database contains the value of claims incurred for material damage and business interruption from these companies. Based on different sources of information, our assessment is that this survey represents about 70% of the total New Zealand insurance market.

3.4 1996 Intra-Industry (Input-Output) Study

This is a database compiled from the 1996 national accounts to measure the direct and indirect relationships between industries and commodities. The resulting Input-Output table enables users to develop industry 'multipliers' to estimate the direct and indirect impact of changes in industry activity for example, due to fire damage.

3.5 Social Cost of Injuries

The Land Transport Safety Authority has developed a methodology based on the 'Value of Statistical Life' to value the social cost of road injuries in New Zealand. These values have been applied to injuries caused by industrial fires in this study.

4 ALL INDUSTRIAL FIRE INCIDENTS

This section examines the incidence of industrial fires with data sourced from the *FIRS* database. Table 3.5.1 shows that the total number of industrial fires since 1996 has ranged from a low of 2,719 incidents in 2000 to a high of 4,095 in 1998. On average, structure fires account for about 36% of all industrial fires, with the miscellaneous and vegetation fire subsets accounting the bulk of the remaining incidents.

Table 3.5.1 Number and type of industrial fire incidents

NUMBER OF FIRES 1996 to 2000	1996	1997	1998	1999	2000	**Average**
Structure fires	1,227	1,367	1,265	1,199	1,100	**1,232**
Miscellaneous fires	748	928	1,166	964	753	**912**
Vegetation fires	787	843	1,226	892	573	**864**
Mobile property fires	440	473	394	363	272	**388**
Hazardous substance fires	43	57	44	28	21	**39**
TOTAL	**3,245**	**3,668**	**4,095**	**3,446**	**2,719**	**3,435**

Source: FIRS, BERL

The number of structure fires has been reasonably consistent over time. By comparison, the number of miscellaneous and vegetation fires has been more erratic especially with respect to 1998, during which time drought conditions no doubt contributed to a large increase in these types of incidents. This pattern is evident in the figure below, with the number of non-structure fires being much more volatile relative to structure fires.

Figure 4.1 Pattern of industrial fire incidents

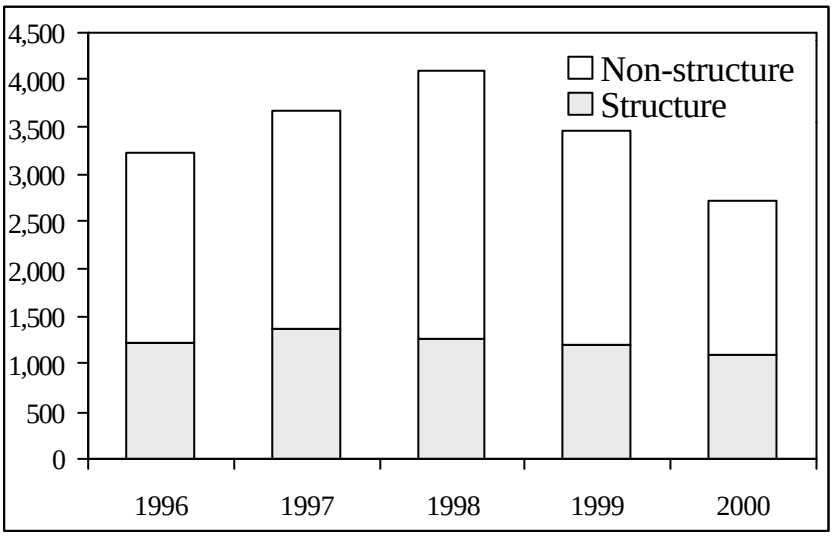


Table 3.5.2 shows the number of all fire incidents by industry group over the past five years. Again, drought conditions have had a pronounced impact on the number of fires by industry with the agriculture, services to agriculture, and forestry and logging groups recording large increases in 1998.

A second notable trend within these broad statistics is the large decrease in fire incidents for machinery and equipment manufacturing. This appears to have been the result of a similarly large decline in mobile property fires for this industry, which has fallen from 172 in 1996 to just 36 in 2000. By comparison, the other types of fires have remained reasonably stable within the machinery and equipment manufacturing industry, which suggests some change within the industry itself may be responsible for the decline.

Table 3.5.2 Number of industrial fire incidents by industry group

NUMBER OF FIRES 1996 to 2000	1996	1997	1998	1999	2000	**Average**
Agriculture	1,070	1,086	1,597	1,232	818	**1,161**
Services to Agriculture; Hunting and Trapping	12	14	61	30	30	**29**
Forestry and Logging	93	93	129	78	52	**89**
Mining	22	23	33	25	14	**23**
Food, Beverage and Tobacco	87	115	113	91	63	**94**
Textile, Clothing, Footwear & Leather Mfg	32	20	24	23	27	**25**
Wood and Paper Product Manufacturing	121	185	163	178	146	**159**
Printing, Publishing and Recorded Media	16	12	6	16	9	**12**
Petroleum, Coal, Chemical & Assoc Prod Mfg	26	36	39	24	21	**29**
Non-Metallic Mineral Product Manufacturing	34	26	22	18	19	**24**
Metal Product Manufacturing	35	47	37	37	25	**36**
Machinery and Equipment Manufacturing	261	216	159	131	102	**174**
Other Manufacturing	64	88	60	75	76	**73**
Electricity and Gas Supply	24	62	64	47	45	**48**
Water Supply, Sewerage and Drainage Services	6	6	12	4	9	**7**
Food Retailing	166	211	185	174	164	**180**
Personal and Household Good Retailing	209	238	242	213	223	**225**
Motor Vehicle Retailing and Services	139	171	175	181	143	**162**
Accommodation, Cafes and Restaurants	135	168	182	168	152	**161**
Transport & Services to Transport	199	282	230	198	142	**210**
Storage and Wholesaling	296	320	342	275	228	**292**
Communication Services	43	51	42	41	47	**45**
Business and Financial Services	117	160	145	159	140	**144**
Personal and Recreational Services	38	38	33	28	24	**32**
TOTAL	**3,245**	**3,668**	**4,095**	**3,446**	**2,719**	**3,435**

Source: FIRS, BERL

Figure 4.2 shows the industry composition of all fire incidents in New Zealand. Note that some of the industries shown in Table 3.5.2 have been combined into broad classes of industries with similar characteristics such as primary production, manufacturing, and retailing. Overall, agriculture (ie farming) accounts for about 34% of all industrial fire incidents. Wood and paper product manufacturing is the most significant industry in the manufacturing sector, accounting for 5% on all industrial fire incidents.

Figure 4.2 Industry composition of all fire incidents

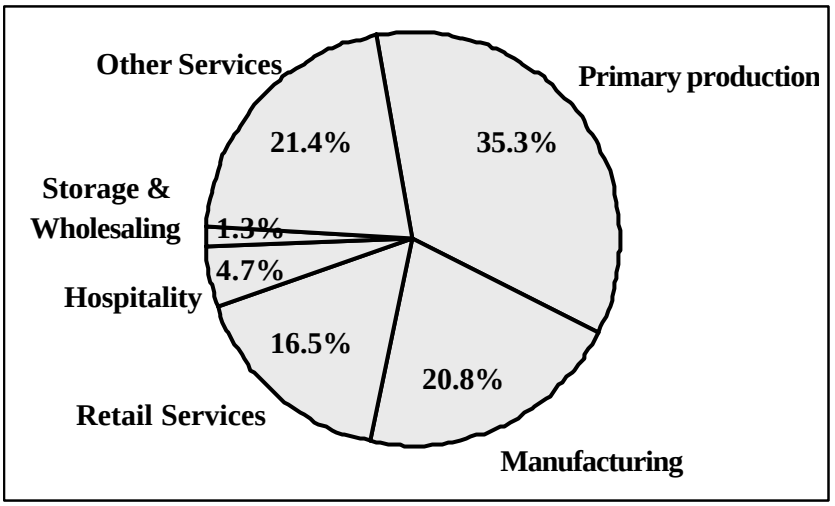


Table 3.5.3 shows the number of all industrial fire incidents by region. The composition or share of fire incidents by region is reasonably consistent over time, with Auckland tending to account for the largest share (about 23%) of industrial fires. By comparison, Northland records the smallest share (at about 4%) of the national total. The contrast between Auckland and Northland is likely to reflect a number of factors including the size and industrial structure of the economy within each region.

Table 3.5.3 Number of industrial fire incidents by region

NUMBER OF FIRES 1996 to 2000	Northland	Auckland	Bay-Waikato	Eastern	Western	Arapawa	Transapline	Southern	**Total**
1996	157	789	467	239	269	428	575	321	**3,245**
1997	174	905	498	282	310	537	591	371	**3,668**
1998	177	813	562	379	409	577	735	443	**4,095**
1999	115	774	531	260	341	421	547	457	**3,446**
2000	100	694	442	169	241	391	387	295	**2,719**
Average	**145**	**795**	**500**	**266**	**314**	**471**	**567**	**377**	**3,435**

Source: FIRS, BERL

5 INDUSTRIAL STRUCTURE FIRES

This section examines the incidence of industrial structure fires with data sourced from the *FIRS* database.

5.1 Incidence of Structure Fires by Industry

Table 5.1.1 shows the number of structure fires by industry since 1996. There were a total of 1,100 fires in 2000 compared. Generally speaking, the composition of structure fires across the industry groups is reasonably consistent over time, although there is arguably a trend decline in the total number of fires since 1997.

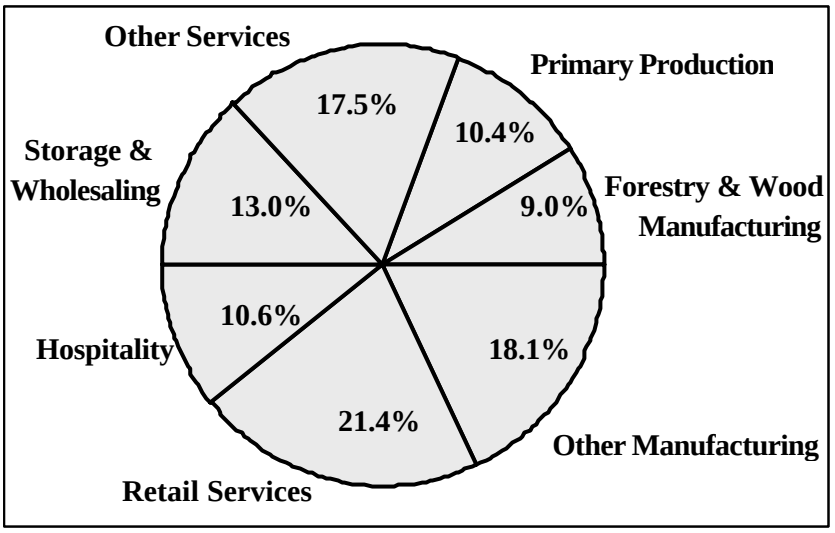
Table 5.1.1 Number of structure fire incidents by industry group

NUMBER OF FIRES	1996	1997	1998	1999	2000	**Average**
Agriculture	140	129	131	109	86	**119**
Services to Agriculture; Hunting and Trapping	3	8	8	4	13	**7**
Forestry & Logging	0	0	0	0	0	**0**
Mining	2	2	5	1	1	**2**
Food, Beverage and Tobacco	62	76	63	63	49	**63**
Textile, Clothing, Footwear & Leather Mfg	21	12	21	14	17	**17**
Wood and Paper Product Manufacturing	89	135	112	110	106	**110**
Printing, Publishing and Recorded Media	12	8	5	13	5	**9**
Petroleum, Coal, Chemical & Assoc Prod Mfg	18	16	20	15	11	**16**
Non-Metallic Mineral Product Manufacturing	19	17	11	6	9	**12**
Metal Product Manufacturing	24	32	22	23	18	**24**
Machinery and Equipment Manufacturing	53	45	37	37	36	**42**
Other Manufacturing	39	52	26	46	44	**41**
Electricity and Gas Supply	9	21	17	18	19	**17**
Water Supply, Sewerage and Drainage Services	5	2	6	3	4	**4**
Food Retailing	106	130	96	106	92	**106**
Personal and Household Good Retailing	106	96	111	92	114	**104**
Motor Vehicle Retailing and Services	47	59	46	57	57	**53**
Accommodation, Cafes and Restaurants	119	132	140	143	120	**131**
Transport & Services to Transport	21	30	23	12	15	**20**
Storage and Wholesaling	174	172	181	152	120	**160**
Communication Services	30	32	31	29	34	**31**
Business and Financial Services	92	133	125	120	113	**117**
Personal and Recreational Services	36	28	28	26	17	**27**
TOTAL	**1,227**	**1,367**	**1,265**	**1,199**	**1,100**	**1,232**

Source: FIRS, BERL

Figure 5.1 shows the industry composition of structure fire incidents using the average number of fires between 1996 and 2000. There are a large number of structure fires in the wood and paper manufacturing industry and for this reason it has been isolated from the rest of the manufacturing sector in the figure below.

Figure 5.1 Industry composition of structure fires



5.2 Incidence of Structure Fires by Region

Table 5.2.1 shows the average number of structure fire incidents by region. Again, the composition of incidents is also reasonably stable when viewed on a regional basis. On average, Auckland accounts for 26% of all structure fires compared to Northland which accounts for just 3%.

Table 5.2.1 Number of structural fire incidents by region

NUMBER OF FIRES	Northland	Auckland	Bay-Waikato	Eastern	Western	Arapawa	Transapline	Southern	Total
1996	32	319	225	85	102	179	164	121	**1,227**
1997	41	350	232	104	120	207	185	128	**1,367**
1998	42	321	208	90	127	176	154	147	**1,265**
1999	31	327	212	74	116	162	160	117	**1,199**
2000	32	305	188	67	90	172	140	106	**1,100**
Average	**36**	**324**	**213**	**84**	**111**	**179**	**161**	**124**	**1,232**

Source: FIRS, BERL

5.3 Prevalence of Industrial Structure Fires

The prevalence of structure fires within each industry and region is shown in Table 5.3.1, which shows the average incidence rate per 1,000 activity units[1]. Although this measure provides a standardised means of comparison, some caution is warranted in interpreting the results, due to the small number of incidents or activity units within

[1] Activity units are defined within Statistics New Zealands Business Demographic database as enterprises with greater than $30,000 annual GST expenses or sales, or enterprises in a GST exempt industry.

some industries. Also, this measure notes the fact that a fire has occurred but does not take into account of the economic costs associated with any damage. Thus, it is simply a measure of the relative 'fire risk' between industries.

Table 5.3.1 Average incidence rate per 1000 activity units

INCIDENCE PER 1000 AUs (Average from 1996 to 2000)	Northland	Auckland	Bay-Waikato	Eastern	Western	Arapawa	Transapline	Southern	**Total**
Agriculture	0.7	1.5	1.4	1.1	1.8	1.6	2.5	2.5	**1.7**
Services to Agriculture; Hunting and Trapping	0.9	5.4	1.5	0.5	2.2	3.7	0.8	2.0	**1.9**
Forestry & Logging	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Mining	0.0	2.1	11.1	0.0	0.0	3.2	2.0	10.0	**4.0**
Food, Beverage and Tobacco	49.9	25.6	39.8	43.9	67.4	27.7	31.8	46.5	**35.4**
Textile, Clothing, Footwear & Leather Mfg	4.2	6.0	2.7	20.5	15.6	4.3	7.8	21.7	**7.8**
Wood and Paper Product Manufacturing	31.4	26.3	135.3	105.5	20.9	36.3	18.9	37.5	**51.1**
Printing, Publishing and Recorded Media	0.0	3.7	2.0	7.7	7.1	3.8	4.9	2.5	**3.9**
Petroleum, Coal, Chemical & Assoc Prod Mfg	7.7	12.6	8.0	10.7	9.6	7.9	14.7	27.9	**12.1**
Non-Metallic Mineral Product Manufacturing	94.7	15.7	9.1	0.0	2.3	8.2	11.1	19.4	**14.5**
Metal Product Manufacturing	2.6	8.6	3.6	5.3	9.3	6.5	5.7	14.5	**7.4**
Machinery and Equipment Manufacturing	12.1	7.2	6.6	5.4	7.1	10.7	8.2	8.1	**7.8**
Other Manufacturing	6.2	12.5	17.4	32.3	17.4	7.7	15.9	13.9	**14.0**
Electricity and Gas Supply	0.0	116.6	34.4	19.2	50.4	48.9	63.6	36.4	**49.1**
Water Supply, Sewerage and Drainage Services	0.0	27.9	18.2	10.0	10.5	11.1	10.3	24.5	**16.1**
Food Retailing	10.5	9.7	11.9	14.7	15.6	11.0	11.0	12.6	**11.4**
Personal and Household Good Retailing	4.4	5.2	4.0	6.1	6.9	5.9	4.9	6.9	**5.4**
Motor Vehicle Retailing and Services	4.0	5.4	3.9	6.8	4.1	6.3	5.0	7.9	**5.3**
Accommodation, Cafes and Restaurants	4.0	17.1	11.4	16.8	13.2	17.3	10.3	13.4	**13.7**
Transport & Services to Transport	7.9	3.9	7.1	16.2	10.9	6.7	3.1	9.6	**5.9**
Storage and Wholesaling	18.0	6.0	17.6	26.4	21.1	15.3	11.8	24.0	**12.2**
Communication Services	6.5	8.1	5.3	11.2	8.6	8.2	6.2	18.5	**8.2**
Business and Financial Services	0.6	1.1	1.0	1.8	1.2	2.0	1.2	1.9	**1.3**
Personal and Recreational Services	0.8	1.4	1.8	2.3	0.9	1.3	0.8	0.9	**1.3**
TOTAL	**2.9**	**4.0**	**4.6**	**5.2**	**4.7**	**4.8**	**4.4**	**5.6**	**4.5**

Source: FIRS, BERL

Three industries exhibit significantly high rates of fire incidence. Firstly, the wood and paper manufacturing group records the highest rate at 51 per 1,000 AUs. Aside from the fire risk associated with processing wood and paper, the industries high rate may also reflect some building losses associated with plantation fires within the forestry and logging group. It is notable in this respect that the central North Island regions of Bay-Waikato and Eastern record especially high rates of fire risk within this industry.

The electricity and gas supply industry group also appears to exhibit a high level of fire risk despite the occurrence of just an average of 17 fire incidents per annum since 1996. The food, beverage and tobacco manufacturing group records the third highest rate of incidence at 35.4 per 1,000 AUs. This high rate is reasonably consistent across New Zealand but especially high in the Western region.

A number of industries exhibit especially low rates of incidence, despite in some cases recording a relatively large number of fire incidents. The agriculture industry group for example, records a relatively low incidence rate of just 1.7 per 1,000 AUs, reflecting the large number of businesses within this sector. Similarly, business and personal services groups exhibit low rates of incidence.

The Southern region shows the highest rate of incidence (5.6) of the fire regions despite being ranked only fifth in terms of the average number of fire incidents. The Northland region shows the lowest incidence rate at just 2.9 and is significantly below the average for all regions across New Zealand (4.5).

However, Northland does exhibit a particularly high incidence rate for the non-metallic mineral product manufacturing group compared to the rest of New Zealand. Similarly, the Southern region exhibits a relatively high rate of incidence for a number of 'heavy industry' manufacturing groups such as the petroleum, non-metallic mineral, and metal product manufacturing industries.

The figures below show the industry groups with the ten highest and lowest incidence rates. Industries within the manufacturing sector tend to exhibit the highest rates of fire incidence, while the service industries tend to show lowest rates of fire incidence.

Figure 5.2 Industries with the highest incidence rate

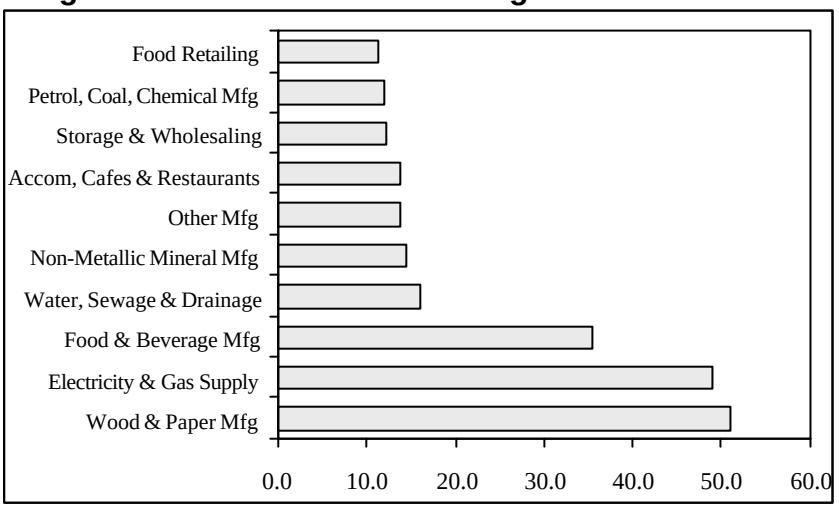
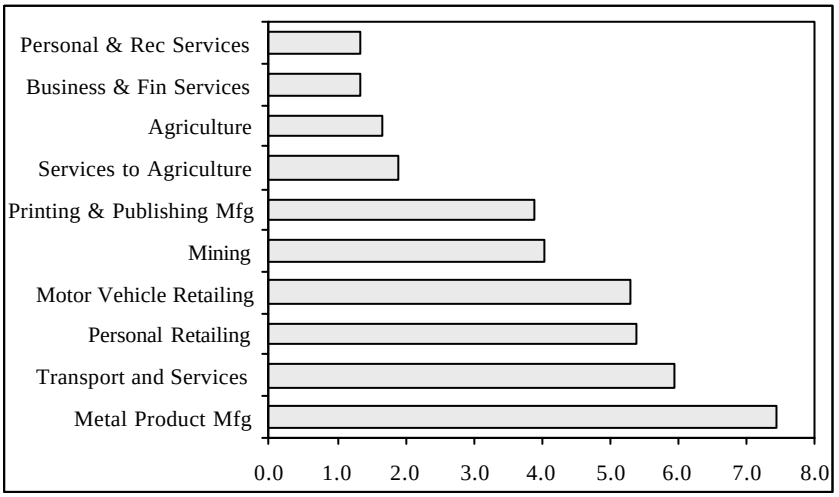


Figure 5.3 Industries with the lowest incidence rate



5.4 Area of Industrial Property Lost

This section calculates the area of industrial property lost due to structure fires based on information contained in the *FIRS* database. In the FIRS system, the *percent of property lost* for each structure fire as well as the *area of structure* is estimated and recorded by the attending fire officer. These records therefore, provide the foundation for estimating the area of property lost for each fire incident.

Table 5.4.1 shows the area of industrial property lost to fire in 2000. It is estimated that a total area of 35,056 square metres was lost to fires in 2000. This figure compares to an estimated loss of 41,499 square metres in 1999.

Table 5.4.1 Square metres of property lost from fires in 2000

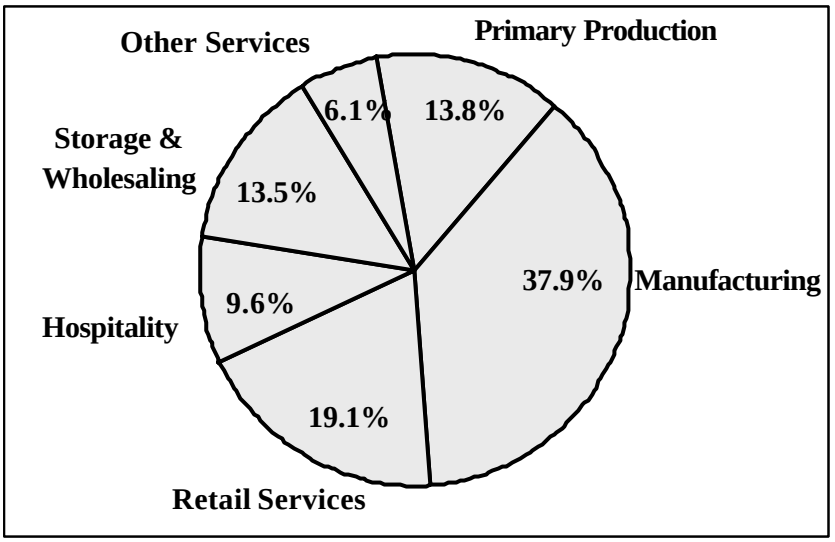
PROPERTY LOST (M^2) 2000	Northland	Auckland	Bay-Waikato	Eastern	Western	Arapawa	Transapline	Southern	**Total**
Agriculture	86	284	925	371	215	166	1,705	731	**4,483**
Services to Agriculture; Hunting and Trapping	0	114	0	0	38	11	0	2	**164**
Forestry & Logging	0	0	0	0	0	0	0	0	**0**
Mining	0	0	0	0	0	0	0	188	**188**
Food, Beverage and Tobacco	0	663	104	0	1,188	691	1,335	63	**4,043**
Textile, Clothing, Footwear & Leather Mfg	0	52	2,375	0	125	0	0	0	**2,552**
Wood and Paper Product Manufacturing	0	13	185	774	6	454	76	32	**1,539**
Printing, Publishing and Recorded Media	0	0	0	0	0	0	63	0	**63**
Petroleum, Coal, Chemical & Assoc Prod Mfg	0	0	113	0	4	0	0	0	**116**
Non-Metallic Mineral Product Manufacturing	0	130	63	0	0	0	0	63	**255**
Metal Product Manufacturing	0	222	0	0	9	0	38	0	**268**
Machinery and Equipment Manufacturing	0	64	431	0	36	0	506	0	**1,037**
Other Manufacturing	0	233	233	38	169	4	2,363	391	**3,430**
Electricity and Gas Supply	0	0	0	0	1	2	9	0	**13**
Water Supply, Sewerage and Drainage Services	0	0	0	0	0	0	0	0	**0**
Food Retailing	0	88	371	64	407	221	1,285	19	**2,455**
Personal and Household Good Retailing	44	496	1,069	49	518	239	188	396	**2,998**
Motor Vehicle Retailing and Services	0	232	309	0	248	160	145	135	**1,228**
Accommodation, Cafes and Restaurants	0	916	419	664	650	347	150	217	**3,362**
Transport & Services to Transport	0	7	109	0	9	8	0	120	**252**
Storage and Wholesaling	14	156	1,193	527	142	1,602	209	881	**4,723**
Communication Services	0	38	0	0	0	134	0	38	**209**
Business and Financial Services	0	516	56	0	128	203	21	63	**987**
Personal and Recreational Services	0	439	11	0	0	244	0	0	**693**
TOTAL	**144**	**4,661**	**7,964**	**2,487**	**3,890**	**4,484**	**8,091**	**3,336**	**35,056**

Source: FIRS, BERL

The damage to buildings tends to be concentrated in a small number of industries which is consistent with the previous section. The industries where most of the building losses have occurred are agriculture (4,483 m^2), storage and wholesaling (4,723 m^2) and food beverage and tobacco manufacturing (4,043 m^2).

Despite the high rate of incidence for wood and paper manufacturing and electricity and gas supply, these industries have recorded relatively small losses in terms of structural building damage. Indeed, it is estimated that only 13 m^2 was lost within the electricity and gas supply group in 2000. By comparison, the textile, clothing, footwear and leather manufacturing group records a loss of 2,552 m^2 from a total of just 17 fires in 2000.

Figure 5.4 Industry composition of property lost



5.5 Extent of Property Lost

This section examines the extent of property damage using information contained in the *FIRS* database. Table 5.5.1 shows the composition of fire incidents and building area lost according to the extent of property damage for each incident. This shows that most fires cause very little damage to industrial buildings with 74% of all incidents causing less than 10% damage to the structure. However, a small number of fires (9%) account for a large proportion (46%) of the total losses in terms of square metres lost. These fires are those that cause extensive damage with than 90% damage to the building.

Table 5.5.1 Composition of property damage in 2000

EXTENT OF DAMAGE 2000	Total Incidents	% of All Fire Incidents	Total Area Lost	% of Total Area Lost
Extent of damage (% of structure lost)	**(Number)**	**(%)**	**(M^2)**	**(%)**
91% to 100%	101	9%	16,181	46%
51% to 90%	42	4%	6,970	20%
11% to 50%	140	13%	6,552	19%
0% to 10%	817	74%	5,352	15%
Total	**1,100**	**100%**	**35,056**	**100%**

Source: FIRS, BERL

This pattern is also evident in the distribution of area lost within each industry as shown in Table 5.5.2 below. The nationwide average is for 46% of total losses to be represented by fire incidents that cause more than 90% damage to the building.

However, a number of industries record relatively high levels of property loss within the 90%-100% range. These industries are agriculture (81%), textile, clothing, footwear and leather manufacturing (94%), wood manufacturing (69%) and storage and wholesaling (66%). By comparison, it would appear that very few fire incidents in the business and personal services sectors cause extensive damage.

Table 5.5.2 Distribution of area lost by extent of property damage

SQUARE METRES LOST 2000	Extent of damage (% of structure lost)				
	0% to 10%	11% to 50%	51% to 90%	91% to 100%	Total Square Metres Lost
Agriculture	48	604	189	3,642	**4,483**
Services to Agriculture; Hunting and Trapping	39	4	114	8	**164**
Forestry & Logging	0	0	0	0	**0**
Mining	0	188	0	0	**188**
Food, Beverage and Tobacco	464	394	1,998	1,188	**4,043**
Textile, Clothing, Footwear & Leather Mfg	144	0	0	2,408	**2,552**
Wood and Paper Product Manufacturing	333	111	26	1,069	**1,539**
Printing, Publishing and Recorded Media	63	0	0	0	**63**
Petroleum, Coal, Chemical & Assoc Prod Mfg	0	116	0	0	**116**
Non-Metallic Mineral Product Manufacturing	143	113	0	0	**255**
Metal Product Manufacturing	104	164	0	0	**268**
Machinery and Equipment Manufacturing	102	488	246	202	**1,037**
Other Manufacturing	275	248	2,515	392	**3,430**
Electricity and Gas Supply	9	4	0	0	**13**
Water Supply, Sewerage and Drainage Services	0	0	0	0	**0**
Food Retailing	369	441	94	1,551	**2,455**
Personal and Household Good Retailing	447	830	120	1,601	**2,998**
Motor Vehicle Retailing and Services	277	426	26	499	**1,228**
Accommodation, Cafes and Restaurants	386	1,503	1,050	423	**3,362**
Transport & Services to Transport	46	127	0	79	**252**
Storage and Wholesaling	344	673	587	3,120	**4,723**
Communication Services	209	0	0	0	**209**
Business and Financial Services	1,186	7	0	0	**1,193**
Personal and Recreational Services	423	64	0	0	**487**
TOTAL	**5,409**	**6,503**	**6,963**	**16,181**	**35,056**

Source: FIRS, BERL

6 DIRECT ECONOMIC IMPACTS

6.1 Value of Building Property Lost

This section assigns a monetary value to the area of structure losses as was estimated in section 5.4. This value is based upon the average square metre cost of construction for different types of buildings as published by the Rawlinsons Group. These construction costs represent the average cost of building a 'structure' and excludes other factors such as the cost of furniture, fittings, machinery, equipment and stock.

The Rawlinsons data is typically used in feasibility studies or property valuations but in this case it provides an estimate of the dollar value of buildings damaged by fire and can be thought of as reflecting the replacement cost of industrial structures.

Table 6.1.1 shows the average cost of construction for each industry. These costs vary by industry from $441 per square metre in the agriculture group to $1,017 per square metre in the hospitality group. The 'weighted-average' across all industries is $630 per square metre. This weighted-average was calculated according to the square metres lost within each industry group.

Table 6.1.1 Average cost of construction per square metre

COST PER SQUARE METRE 2000	Preliminary	Substructure	Superstructure	Finishes	Fittings & fixtures	Services External works, drainage	Contingency	**TOTAL**
Agriculture	$30	$80	$275	$9	$2	$34	$7	$4	**$441**
Services to Agriculture; Hunting and Trapping	$30	$80	$275	$9	$2	$34	$7	$4	**$441**
Mining	$42	$81	$228	$52	$51	$151	$11	$8	**$624**
Food, Beverage and Tobacco	$35	$109	$310	$48	$3	$36	$5	$6	**$552**
Textile, Clothing, Footwear & Leather Mfg	$37	$63	$248	$58	$37	$123	$8	$7	**$583**
Wood and Paper Product Manufacturing	$32	$83	$318	$29	$8	$53	$5	$5	**$534**
Printing, Publishing and Recorded Media	$37	$63	$248	$58	$37	$123	$8	$7	**$583**
Petroleum, Coal, Chemical & Assoc Prod Mfg	$52	$89	$320	$70	$53	$185	$12	$12	**$792**
Non-Metallic Mineral Product Manufacturing	$42	$81	$228	$52	$51	$151	$11	$8	**$624**
Metal Product Manufacturing	$42	$81	$228	$52	$51	$151	$11	$8	**$624**
Machinery and Equipment Manufacturing	$42	$81	$228	$52	$51	$151	$11	$8	**$624**
Other Manufacturing	$37	$80	$247	$35	$32	$104	$9	$7	**$550**
Electricity and Gas Supply	$42	$81	$228	$52	$51	$151	$11	$8	**$624**
Water Supply, Sewerage and Drainage Services	$42	$81	$228	$52	$51	$151	$11	$8	**$624**
Food Retailing	$47	$75	$308	$92	$8	$107	$11	$7	**$654**
Personal and Household Good Retailing	$62	$79	$362	$86	$10	$236	$10	$9	**$853**
Motor Vehicle Retailing and Services	$36	$82	$316	$36	$5	$43	$8	$5	**$530**
Accommodation, Cafes and Restaurants	$72	$79	$423	$123	$76	$217	$16	$12	**$1,017**
Transport & Services to Transport	$44	$80	$331	$55	$23	$107	$9	$9	**$658**
Storage and Wholesaling	$34	$101	$299	$39	$3	$35	$5	$5	**$521**
Communication services	$43	$61	$333	$90	$23	$140	$9	$9	**$709**
Finance and Business services	$51	$66	$412	$108	$8	$180	$11	$9	**$846**
Personal and Recreational services	$48	$66	$394	$104	$7	$118	$10	$9	**$757**
Weighted Average	**$41**	**$75**	**$300**	**$56**	**$24**	**$113**	**$9**	**$7**	**$625**

Source: Rawlinsons, BERL

Table 6.1.2 shows the value of building property lost in 2000. These estimates are based on the average construction costs shown in Table 6.1.1 and the area of structural damage shown in Table 5.4.1. The value of building property lost to fire is estimated at about $22 million in 2000. This compares closely to the estimate of $25 million in 1999.

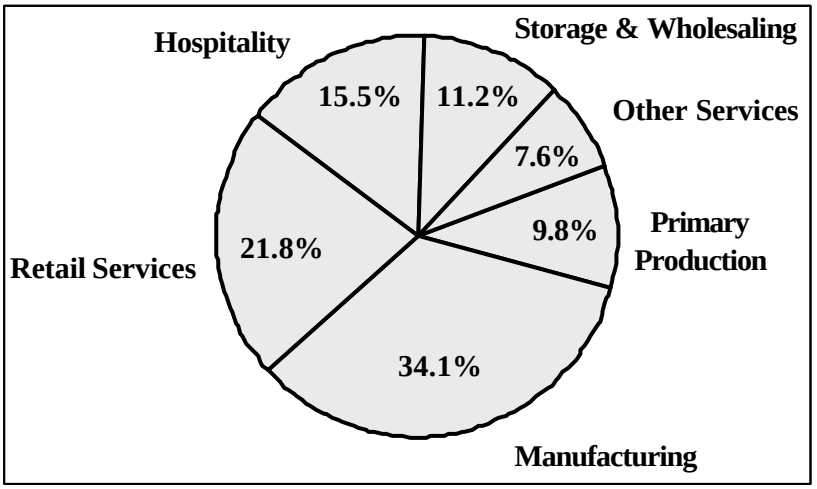
Table 6.1.2 Value of building property lost ($000s)

PROPERTY LOST ($000) 2000	Northland	Auckland	Bay-Waikato	Eastern	Western	Arapawa	Transapline	Southern	Total
Agriculture	$38	$125	$408	$164	$95	$73	$752	$322	**$1,977**
Services to Agriculture; Hunting and Trapping	$0	$50	$0	$0	$17	$5	$0	$1	**$73**
Forestry & Logging	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
Mining	$0	$0	$0	$0	$0	$0	$0	$117	**$117**
Food, Beverage and Tobacco	$0	$366	$57	$0	$656	$382	$737	$35	**$2,233**
Textile, Clothing, Footwear & Leather Mfg	$0	$30	$1,384	$0	$73	$0	$0	$0	**$1,487**
Wood and Paper Product Manufacturing	$0	$7	$99	$413	$3	$242	$41	$17	**$822**
Printing, Publishing and Recorded Media	$0	$0	$0	$0	$0	$0	$36	$0	**$36**
Petroleum, Coal, Chemical & Assoc Prod Mfg	$0	$0	$89	$0	$3	$0	$0	$0	**$92**
Non-Metallic Mineral Product Manufacturing	$0	$81	$39	$0	$0	$0	$0	$39	**$159**
Metal Product Manufacturing	$0	$138	$0	$0	$5	$0	$23	$0	**$167**
Machinery and Equipment Manufacturing	$0	$40	$269	$0	$22	$0	$315	$0	**$647**
Other Manufacturing	$0	$128	$128	$21	$93	$2	$1,301	$215	**$1,888**
Electricity and Gas Supply	$0	$0	$0	$0	$1	$1	$6	$0	**$8**
Water Supply, Sewerage and Drainage Services	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
Food Retailing	$0	$57	$243	$42	$266	$144	$840	$12	**$1,604**
Personal and Household Good Retailing	$37	$424	$912	$42	$442	$204	$160	$338	**$2,559**
Motor Vehicle Retailing and Services	$0	$123	$164	$0	$131	$85	$77	$72	**$651**
Accommodation, Cafes and Restaurants	$0	$931	$426	$675	$661	$352	$153	$221	**$3,419**
Transport & Services to Transport	$0	$4	$72	$0	$6	$5	$0	$79	**$166**
Storage and Wholesaling	$7	$81	$621	$275	$74	$835	$109	$459	**$2,461**
Communication Services	$0	$27	$0	$0	$0	$95	$0	$27	**$148**
Business and Financial Services	$0	$437	$48	$0	$108	$172	$18	$53	**$835**
Personal and Recreational Services	$0	$332	$8	$0	$0	$184	$0	$0	**$525**
TOTAL	**$82**	**$3,382**	**$4,966**	**$1,631**	**$2,655**	**$2,782**	**$4,567**	**$2,006**	**$22,072**

Source: FIRS, Rawlinsons, BERL

Figure 6.1 shows the industry composition of structure property losses in 2000. The two main industries within manufacturing are food, beverage, and tobacco manufacturing and textile, clothing, footwear, and leather manufacturing.

Figure 6.1 Industry composition of value of property lost



6.2 Industrial Fire Claims

This section assesses the direct economic cost of all industrial fire incidents as recorded by the value of insurance claims. These estimates are based on a survey of the five main insurance companies. Based upon consultation with the insurance industry, we estimate that these respondents account for about 70% of New Zealand's total insurance market. The current report uses survey data from an 'Interim Survey Panel' consisting of four insurance companies with the survey data from the final company to come. We estimate that the interim survey data accounts for about 50% of the total insurance market.

6.2.1 Survey of Fire Claims

Table 6.2.1 shows the total value of insurance claims from the Interim Survey Panel came to $22.0 million in 2000. This total consists of $18.0 million in material damage claims and $4.0 million in business interruption claims. Material damages include claims for damage to all property such as buildings and vehicles as well as machinery, equipment, and stock. These claims therefore include the building damages estimated in section 6.1. Business interruption includes the direct cost to businesses from the disruption to output as a result of fire. Generally speaking, these claims include wages and profits lost as a result of this disruption.

Table 6.2.1 Interim Survey Panel insurance claim data for 2000

CLAIMS INCURRED ($) 2000	Material Damage	Business Interruption	**Total**
Agriculture	$5,921,000	$14,000	**$5,935,000**
Services to Agriculture; Hunting and Trapping	$49,000	$46,000	**$96,000**
Forestry & Logging	$0	$0	**$0**
Mining	$7,000	$0	**$7,000**
Food, Beverage and Tobacco	$175,000	$129,000	**$304,000**
Textile, Clothing, Footwear & Leather Mfg	$2,110,000	$668,000	**$2,778,000**
Wood and Paper Product Manufacturing	$652,000	$25,000	**$677,000**
Printing, Publishing and Recorded Media	$56,000	$0	**$56,000**
Petroleum, Coal, Chemical & Assoc Prod Mfg	$243,000	$50,000	**$293,000**
Non-Metallic Mineral Product Manufacturing	$1,134,000	$83,000	**$1,217,000**
Metal Product Manufacturing	$23,000	$8,000	**$31,000**
Machinery and Equipment Manufacturing	$193,000	$35,000	**$229,000**
Other Manufacturing	$384,000	$34,000	**$418,000**
Electricity and Gas Supply	$3,000	$0	**$3,000**
Water Supply, Sewerage and Drainage Services	$0	$0	**$0**
Food Retailing	$712,000	$135,000	**$847,000**
Personal and Household Good Retailing	$1,524,000	$232,000	**$1,756,000**
Motor Vehicle Retailing and Services	$257,000	$72,000	**$328,000**
Accommodation, Cafes and Restaurants	$2,085,000	$343,000	**$2,428,000**
Transport & Services to Transport	$96,000	$0	**$96,000**
Storage and Wholesaling	$655,000	$1,631,000	**$2,286,000**
Communication Services	$0	$0	**$0**
Business and Financial Services	$1,612,000	$414,000	**$2,026,000**
Personal and Recreational Services	$180,000	$0	**$180,000**
TOTAL	**$18,072,000**	**$3,919,000**	**$21,992,000**

Source: Interim Survey Panel, BERL

6.2.2 Estimates of the Total Market

The total value of insurance claims from the interim survey came to $22.0 million with industry sources indicating that this figure represents about 50% of the total insurance market. The Interim Survey Panel data can therefore be scaled up by a factor of 2 which implies a total market value of about $44 million. This estimate can be crosschecked for 'order-of-magnitude' through two different and independent sources.

First, data published by the Insurance Council of New Zealand indicates that the value of all business claims was $108 million in 2000. These claims include those incurred for fire, flood, theft, white-collar crime, etc, and is it is not unreasonable that claims related to fire only would be around 30-50% of all business insurance claims.

Secondly, the number of insurance claims can be compared to the number of industrial fire incidents as recorded in *FIRS*. The Interim Survey Panel records a total of 1,406 fire incidents with claims, compared to the total of 2,719 for all industrial fires recorded in *FIRS*. Hence, the survey data would appear to capture about 50% of all industrial fires, supporting the view that the data collected from the interim survey represents about 50% of the total market.

However, some caution is warranted in this comparison given that the two data sets do not necessarily 'match' because some incidents will be too small to justify a claim while other incidents incur claims without an emergency call being made. The latter case leads to an element of 'under-reporting' in the *FIRS* database.

The three independent sources of data (the insurance companies, the Insurance Council and FIRS) all support the view that the Interim Survey Panel data has captured about 50% of the market. Thus, there can be a reasonable level of confidence in the quantum of insurance claims generated from applying a scaling factor of 2.

On the basis of our estimate that the Interim Survey Panel data accounts for 50% of the total market, estimates of the total value of claims by industry in the whole market have been estimated by doubling the claim components for the Interim Survey Panel. These total 'market' estimates for each industry are shown in Table 6.2.2

Note that the figures in Table 6.2.2 will change when data from the fifth insurance company becomes available. Also, note that the fifth insurance company may have a disproportionate market share in some industries and thus, Table 6.2.2 may tend to understate the value of insurance claims for these industries.

Table 6.2.2 Market estimate of material damage and business interruption

MARKET ESTIMATE OF CLAIMS INCURRED 2000	Material Damage	Business Interruption	Total
Agriculture	$11,842,000	$29,000	**$11,870,000**
Services to Agriculture; Hunting and Trapping	$99,000	$92,000	**$191,000**
Forestry & Logging	$0	$0	**$0**
Mining	$13,000	$0	**$13,000**
Food, Beverage and Tobacco	$350,000	$258,000	**$609,000**
Textile, Clothing, Footwear & Leather Mfg	$4,220,000	$1,336,000	**$5,556,000**
Wood and Paper Product Manufacturing	$1,304,000	$50,000	**$1,355,000**
Printing, Publishing and Recorded Media	$113,000	$0	**$113,000**
Petroleum, Coal, Chemical & Assoc Prod Mfg	$485,000	$100,000	**$585,000**
Non-Metallic Mineral Product Manufacturing	$2,269,000	$166,000	**$2,434,000**
Metal Product Manufacturing	$46,000	$15,000	**$61,000**
Machinery and Equipment Manufacturing	$387,000	$71,000	**$457,000**
Other Manufacturing	$768,000	$68,000	**$837,000**
Electricity and Gas Supply	$6,000	$0	**$6,000**
Water Supply, Sewerage and Drainage Services	$0	$0	**$0**
Food Retailing	$1,424,000	$270,000	**$1,694,000**
Personal and Household Good Retailing	$3,048,000	$464,000	**$3,512,000**
Motor Vehicle Retailing and Services	$513,000	$143,000	**$656,000**
Accommodation, Cafes and Restaurants	$4,171,000	$686,000	**$4,857,000**
Transport & Services to Transport	$192,000	$0	**$192,000**
Storage and Wholesaling	$1,310,000	$3,261,000	**$4,571,000**
Communication Services	$0	$0	**$0**
Business and Financial Services	$3,225,000	$827,000	**$4,052,000**
Personal and Recreational Services	$360,000	$0	**$360,000**
TOTAL	**$36,145,000**	**$7,838,000**	**$43,983,000**

Source: Interim Survey Panel, BERL

6.3 Consistency of Estimated Claims and FIRS Property Loss

A further check on the Interim Survey Panel share of the total market can be carried out on an industry-by-industry basis. This is achieved by comparing the value of material damage claims by industry in Table 6.2.2 above, with the estimate of the value of building property lost as derived from the *FIRS* database and the Rawlinsons costings as reported in Table 6.1.2.

In this comparison, the value of material damage for each industry would be expected to exceed the value of building property lost within that industry, and the difference would comprise the trade goods or stock, and equipment destroyed by fire. These estimates for each industry are compared in Table 6.3.1 below.

Table 6.3.1 Comparison of estimates of material damage costs

COMPARISON OF ESTIMATES OF MATERIAL DAMAGE COSTS ($) 2000 ESTIMATE DATA SOURCE	Property Lost FIRS data ($ million)	Material Damages [1] (incl property lost) Claims data ($ million)	Non-Property Material Lost Difference ($ million)	Ratio, where Property Lost = 1.0
Industries with probable stock and equipment losses				
Agriculture	$1.98	$11.84	$9.86	6.0
Non-Metallic Mineral Product Manufacturing	$0.16	$2.27	$2.11	14.3
Business and Financial Services	$0.83	$3.22	$2.39	3.9
Industries with probable mainly stock losses				
Textile, Clothing, Footwear & Leather Mfg	$1.49	$4.22	$2.73	2.8
Petroleum, Coal, Chemical & Assoc Prod Mfg	$0.09	$0.49	$0.39	5.3
Wood and Paper Product Manufacturing	$0.82	$1.30	$0.48	1.6
Accommodation, Cafes and Restaurants	$3.42	$4.17	$0.75	1.2
Personal and Household Good Retailing	$2.56	$3.05	$0.49	1.2
Industries where property may be somewhat over-valued				
Food Retailing	$1.60	$1.42	-$0.18	0.9
Motor Vehicle Retailing and Services	$0.65	$0.51	-$0.14	0.8
Storage and Wholesaling	$2.46	$1.31	-$1.15	0.5
Low Fire-damage Industries				
Machinery and Equipment Manufacturing	$0.65	$0.39	-$0.26	0.6
Personal and Recreational Services	$0.52	$0.36	-$0.16	0.7
Other transport; Services to Transport	$0.17	$0.19	$0.03	1.2
Printing, Publishing and Recorded Media	$0.04	$0.11	$0.08	3.1
Services to Agriculture; Hunting and Trapping	$0.07	$0.10	$0.03	1.4
Metal Product Manufacturing	$0.17	$0.05	-$0.12	0.3
Mining	$0.12	$0.01	-$0.10	0.1
Electricity and Gas Supply	$0.01	$0.01	$0.00	0.8
Communication Services	$0.15	$0.00	-$0.15	0.0
Forestry and logging	$0.00	$0.00	$0.00	
Water Supply, Sewerage and Drainage Services	$0.00	$0.00	$0.00	
Industries where databases inconsistent				
Other Manufacturing	$1.89	$0.77	-$1.12	0.4
Food, Beverage and Tobacco	$2.23	$0.35	-$1.88	0.2
TOTAL MARKET ESTIMATE ($)	$22.07	$36.14	$14.07	1.6
Total Excluding Agriculture	$20.09	$24.30	$4.21	1.2

Source: BERL

Generally speaking, for industries with substantial insurance claims, the estimated value of material damages is greater than the estimated value of building property lost as estimated from *FIRS*. Agriculture is a stand-out industry in this regard and the estimated material damage exceeds the value of building damage by $10 million. In fact, material damages are six times the value of building damages. This is understandable given that buildings in agriculture are generally fairly basic, they may house expensive equipment, or stored goods, and also standing crop may be included in the claims data.

With the exclusion of agriculture, the average estimate of material damage claims is 1.2 times the estimate of building damages. Many industries have estimates that are close to this ratio of 1.2. This is very reassuring as to the consistency of the survey, especially since the information in the two sets of estimates comes from a range of sources. The table shows industries in categories such that some of the variances can be explained.

Some variance from the average could be expected in agriculture as discussed above, and the non-metallic mineral manufacturing industry includes limework and glasswork enterprises. A fire in a glassworks would likely interrupt the production process and cause significant loss and damage to stock and equipment. Fires in premises of business and financial services would cause significant loss of computer equipment and possibly databases etc, thus giving high non-building claims.

The next group of five industries record estimates of substantial material damage claims and property figures, which are in a range that is consistent with the average and with expectations.

The following group of three industries (food retailing, vehicle retailing and storage and wholesaling) have estimates of building damages which somewhat exceed the estimates of total material damage from the insurance claim data. This could be due to some over-valuation of the relatively 'basic' building structures used by these industries.

There is a group of eleven industries where both material damages and building losses were very small in 2000. The ratios for many of these are consistent, but with small numbers like these it is possible for some relatively wide variances if the data samples differ much at all.

The two main industries where there are indications that the claims data sample is not consistent with the *FIRS* database are the 'other manufacturing' classification, and the 'food, beverages and tobacco manufacturing' group. The former industry is purely the residual, and if one database is more thorough than the other in classifying all incidents under their actual manufacturing industry, then these estimates will clearly diverge.

With food, beverages and tobacco manufacturing, the claims figure is low for this large, complex industry with its high-energy processes in food processing etc. The number of claims recorded by the Interim Survey Panel were 27, whereas the number of fires recorded in the *FIRS* database was 65.

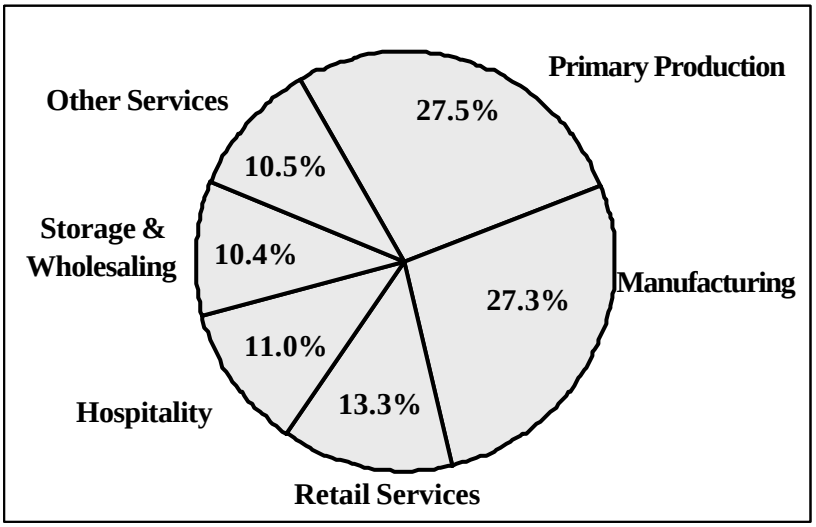
Thus, it is quite probable that a substantial fire (or even a number) included in the *FIRS* database was not covered by the insurance companies in the Survey Panel. It is in fact quite possible that the one insurance company, which was unable to supply data within the timeframe, may insure a disproportionate section of this industry. If this is the case, our estimates of the economic cost of industrial fires in this industry would be an under-estimate.

Overall the two sets of estimates of damage costs due to fire show quite a high level of consistency with variances in industries where variances could be expected. The order of magnitude of these figures are therefore confirmed, and the existence of reasonably consistent industry-by-industry differences are also confirmed. This research shows that insurance claims can be used to infer business and economic information on the costs of fires, which in turn, can be used to enhance the wealth of incident-specific information obtained from the *FIRS* database.

6.4 Industry Pattern of Claims

Figure 6.2 shows the industry composition of total insurance claims in 2000. This figure shows that claims by agriculture are as large as the total of all manufacturing industries, and that these two together comprise more than one-half of the claims. At the other end of the spectrum the large and complex 'services' sector of the economy accounts for only about 10% of the total value of claims.

Figure 6.2 Total insurance claims in 2000



Because building damages would be included as part of the businesses overall claim for material damages, it is interesting to compare the value of property lost estimated from *FIRS* in section 6.2.1 with the value of material damages. This provides an indication of building damages compared with other business goods and assets destroyed within each industry. This comparison is shown in Figure 6.3 where the estimated value of building losses is given as a percentage of total material damages for each industry group.

Primary production records the lowest percentage, indicating that much of the material damage relates to non-building loses such as damage to crops. Storage and wholesaling is also relatively low, indicating that about one-half of the total material damages in this group are accounted for by damage to goods in storage. By comparison, the hospitality group records a high percentage, presumably reflecting fire damage to accommodation.

Figure 6.3 property lost as a percent of material damages

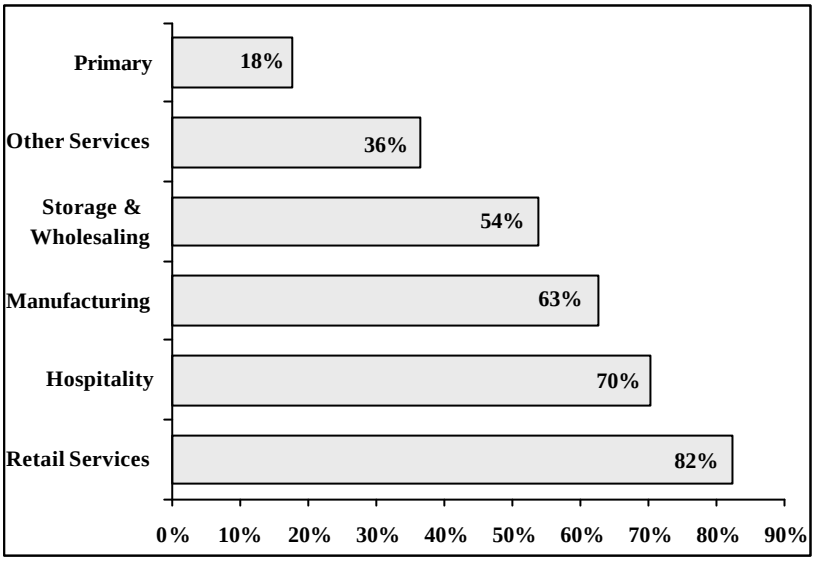
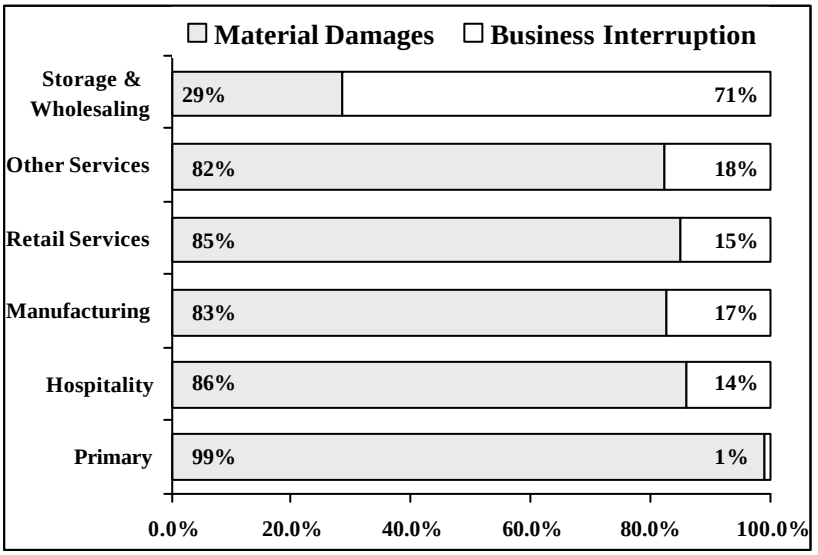


Figure 6.4 shows that insurance claims are dominated by material damage insurance in most industries. However, material damages account for just 29% of total claims in the storage and wholesaling group. This may reflect the case that the storage and wholesale businesses do not undertake activities that would require intensive use of equipment and that they tend to have a high turnover of stock, suggesting relatively large costs from disruption to business.

Figure 6.4 Share of insurance claims by industry



7 COST OF EMERGENCY RESPONSE SERVICES

This section provides a framework for estimating the output costs (ie net expenditure) of emergency response services to industrial fires.

7.1 Identification of Output Costs

This section makes an assessment of the total resources used by the New Zealand Fire Service in responding to fire and non-fire emergencies. Net expenditure on emergency response services is recorded in the NZFSC's Annual Report for June 2000. These costs are shown in Table 7.1.1 below. Total net expenditure in Output Class 2 (ie fire fighting and other fire service operations) was $172.0 million in 2000, representing 94% of the NZFSC's total net expenditure.

The cost of fire fighting is included here as Output 2.6 and accounts for $15.8 million in net expenditure. However, these responses could not have been made if the Fire Service is not kept in a state of operational readiness as shown under Output 2.1 and if the other facilitating functions (Outputs 2.2-2.5) are not undertaken. In our assessment therefore, all of the six categories within Output Class 2 represent the output costs associated with emergency response services.

Table 7.1.1 Net operational expenditure in 2000

OPERATIONAL COSTS 1999/00	**Output Class**	**Net Expenditure $000s**
Operational Readiness	2.1	$145,986
Evacuation Schemes, Alarm Systems & Tactical Plans	2.2	$4,182
Municipal & Building Fire Water Supply	2.3	$5,187
National Co-ordination of Fire Services	2.4	$396
Evaluation of Volunteer & Industrial Brigades	2.5	$396
Operational Responses to Fire & Other Emergencies	2.6	$15,827
Fire Fighting and Other Fire Service Operations	**2**	**$171,974**

Source: NZFSC Annual Report for the year ended June 2000

7.2 Allocation of Emergency Response Costs

The output costs shown above need to be allocated among a number of incident types to assess the overall magnitude of costs associated with industrial fires. Specifically, these costs need to be allocated between fire and non-fire incidents and between industrial fire and non-industrial fires. Finally, given the level of resources used in fighting industrial structure fires, a distinction is made between structure and non-structure industrial fires.

Table 7.2.1 shows the composition of all incidents for the year ending June 2000 as taken from the FIRS database. The grand total of 59,346 incidents includes 24,372 false

alarm and good intent calls, 14,915 non-fire incidents and 20,059 fire incidents. In turn, all fire incidents are comprised of 10,212 public/other fires, 7,128 residential fires and 2,719 industrial fires. Note that there has been a re-allocation of approximately 250 industrial fire incidents into public and other incidents due to the classification of what defines an industrial fire. For example, 'public carparks' are excluded from the industry definition and therefore, have been reallocated to public and other fire incidents.

Table 7.2.1 Broad composition of all incidents in 2000

RESOURCE DELIVERED 2000	Total Number of incidents	Total Number of Appliances	Total Minutes (elapsed time)	Average Appliance Per Incident	Average Minutes Per Incident	Average Appliance X Minutes
False alarms and good intent calls	**24,372**	**60,922**	**449,373**	**2.5**	**18**	**46**
Non-fire incidents	**14,915**	**27,540**	**324,581**	**1.8**	**22**	**40**
All Fire incidents	**20,059**	**41,659**	**498,959**	**2.1**	**25**	**52**
Public and other fires	10,212	17,814	252,126	1.7	25	43
Residential fires	7,128	15,877	171,654	2.2	24	54
Industrial fires	2,719	7,968	75,179	2.9	28	81
ALL	**59,346**	**130,121**	**1,272,913**	**2.2**	**21**	**47**

Source: FIRS, BERL

The total minutes (elapsed time) in the third column of Table 7.2.1 relates to the minutes between the *call creation time* and the *stop time.* The final column in Table 7.2.1 provides a broad estimate of the quantum of resource delivered to each type of incident based upon the average appliance minutes spent attending to the incident. It is evident that industrial fires require a relatively high level of resources with an average of 81 appliance-minutes compared to the average across all incidents of 47 appliance-minutes. This variable also provides a 'matrix' from which to allocate the output costs of $172m to each type of incident. This calculation is shown in the table below, with industrial fires accounting for 14% or $23.3 million of total output costs.

False alarm and good intent calls have been excluded from this calculation because the type of incident is not recorded in FIRS. This exclusion means that the resources used in responding to false alarm and good intent calls are implicitly assumed to be allocated across the all incidents on a pro-rata basis.

Table 7.2.2 Allocation of output costs for 2000

RESOURCE DELIVERED 2000	Total Number of incidents	Average Appliance X Minutes	Resources Delivered (appliance hours)	% of Resources Delivered	Allocation of NZFSC Operational Costs ($000)
False alarms and good intent calls	24,372	46	18,721	n/a	n/a
Non-fire incidents	**14,915**	**40**	**9,989**	**37%**	**$63,254**
All Fire incidents	**20,059**	**52**	**17,375**	**64%**	**$110,024**
Other/Misc fires	10,212	43	7,330	27%	$46,417
Residential fires	7,128	54	6,372	23%	$40,353
Industrial fires	2,719	81	3,672	14%	$23,253
ALL ACTIVE INCIDENTS	**34,974**	**47**	**27,157**	**100%**	**$171,974**

Source: FIRS, BERL

The quantum of resource delivered also varies according to the type of fire incident with structure fires being especially resource intensive. The output costs of $23.3 million for industrial fires can be further broken down into structure and non-structure reflect this difference. This breakdown is shown in Table 7.2.3. The relatively high level of resource delivered to structure industrial fires is evident with an average of 4.1 appliances per incident compared to 2.1 for non-structure industrial fires.

Table 7.2.3 Resource delivered to structure and non-structure fires

RESOURCE DELIVERED 2000	Number of Incidents	Number of Appliances	Average Appliance Per Incident	Allocation of NZFSC Operational Costs ($000)
Total industrial Incidents *(FIRS)*	**2,719**	**7,968**	**2.9**	**$23,253**
Structure fires	1,100	4,546	4.1	$13,266
Non-structure fires	1,619	3,422	2.1	$9,987

Source: FIRS, BERL

Table 7.2.4 shows the allocation of the output costs associated with industrial structure fires in 2000. The output costs are allocated between the industry groups on the basis of the total number of appliances attending. The numbers indicate that the average output cost per industrial structure fire incident is about $12,000.

Table 7.2.4 resource delivered to structure industry fires

RESOURCE DELIVERED TO STRUCTURE FIRES 2000	Total No of incidents	Total No of Appliances	Average Appliance Per Incident	Allocation of NZFSC Operational Costs ($000)
Agriculture	86	286	3.3	$835
Services to Agriculture; Hunting and Trapping	13	45	3.5	$131
Forestry and logging	0	0	0	$0
Mining	1	4	4.0	$12
Food, Beverage and Tobacco	49	264	5.4	$770
Textile, Clothing, Footwear & Leather Mfg	17	63	3.7	$184
Wood and Paper Product Manufacturing	106	384	3.6	$1,121
Printing, Publishing and Recorded Media	5	23	4.6	$67
Petroleum, Coal, Chemical & Assoc Prod Mfg	11	41	3.7	$120
Non-Metallic Mineral Product Manufacturing	9	57	6.3	$166
Metal Product Manufacturing	18	92	5.1	$268
Machinery and Equipment Manufacturing	36	131	3.6	$382
Other Manufacturing	44	166	3.8	$484
Electricity and Gas Supply	19	57	3.0	$166
Water Supply, Sewerage and Drainage Services	4	16	4.0	$47
Food Retailing	92	257	2.8	$750
Personal and Household Good Retailing	114	472	4.1	$1,377
Motor Vehicle Retailing and Services	57	260	4.6	$759
Accommodation, Cafes and Restaurants	120	592	4.9	$1,728
Transport & Services to Transport	15	63	4.2	$184
Storage and Wholesaling	120	513	4.3	$1,497
Communication Services	34	99	2.9	$289
Business and Financial Services	113	537	4.8	$1,567
Personal and Recreational Services	17	124	7.3	$362
TOTAL	**1,100**	**4,546**	**4.1**	**$13,266**

Source: FIRS, BERL

The average output cost per non-structure industrial fire incident is estimated at $6,169 in 2000. Given that at least one fire appliance attends a fire incident and that most of the non-structure fire incidents occurred in the agriculture group, it is unlikely that much information would be uncovered from a closer examination of non-structure industrial fire incidents by industry group. Therefore, the output costs of non-structure industrial fire incidents have been allocated among the industry groups according to the average cost of $6,169 per incident. The total output costs of emergency response services for each industry group are shown in Table 7.2.5.

Table 7.2.5 Resource delivered to all industry fires

RESOURCE DELIVERED 2000	**Allocation of NZFSC Operational Costs ($000)**		
	Structure	Non-structure	**Total**
Agriculture	$835	$4,516	**$5,350**
Services to Agriculture; Hunting and Trapping	$131	$105	**$236**
Forestry and Logging	$0	$321	**$321**
Mining	$12	$80	**$92**
Food, Beverage and Tobacco	$770	$86	**$857**
Textile, Clothing, Footwear & Leather Mfg	$184	$62	**$246**
Wood and Paper Product Manufacturing	$1,121	$247	**$1,367**
Printing, Publishing and Recorded Media	$67	$25	**$92**
Petroleum, Coal, Chemical & Assoc Prod Mfg	$120	$62	**$181**
Non-Metallic Mineral Product Manufacturing	$166	$62	**$228**
Metal Product Manufacturing	$268	$43	**$312**
Machinery and Equipment Manufacturing	$382	$407	**$789**
Other Manufacturing	$484	$197	**$682**
Electricity and Gas Supply	$166	$160	**$327**
Water Supply, Sewerage and Drainage Services	$47	$31	**$78**
Food Retailing	$750	$444	**$1,194**
Personal and Household Good Retailing	$1,377	$672	**$2,050**
Motor Vehicle Retailing and Services	$759	$531	**$1,289**
Accommodation, Cafes and Restaurants	$1,728	$197	**$1,925**
Transport & Services to Transport	$184	$783	**$967**
Storage and Wholesaling	$1,497	$666	**$2,163**
Communication Services	$289	$80	**$369**
Business and Financial Services	$1,567	$167	**$1,734**
Personal and Recreational Services	$362	$43	**$405**
TOTAL	**$13,266**	**$9,987**	**$23,253**

Source: FIRS, BERL

8 INDIRECT ECONOMIC IMPACTS

The insurance claims data provides an estimate of the 'direct' costs of industrial fires in terms of the value of material damage and business interruption insurance. This section calculates the 'indirect' costs on other businesses caused by the reduction in economic activity in the businesses directly affected by fire incidents. These costs are expressed as reductions in economic activity or alternatively the level of employment associated with this activity.

The analysis in this section is based on the Inter-Industry (Input-Output) Study, which measures the direct and indirect relationships between industries and commodities in the New Zealand economy. This enables users to develop industry 'multipliers' to estimate the indirect impact of changes in economic activity. Although this is a standard form of analysis in applied economic research, it should be noted that the analysis provides only a broad 'brush stroke' picture of the economic impact of industrial fires.

An alternative form of analysis would involve case studies to more accurately gauge the wider economic and social impact of specific fire incidents. For example, it may be that some fires have far reaching implications for economic activity and employment in a region or community, particularly if the incident should lead to the permanent closure of the business or the temporary (or permanent) restructuring of industry activity.

8.1 Impact on Economic Activity

The direct impact of business interruption claims incurred for the total insurance market is estimated at about $7.8 million in 2000. While the costs of business interruption will vary as between options in certain insurance policies, they generally include wages and expenses, as well as profits foregone as a result of the fire. These are the components of Value Added (ie GDP) in a technical economic sense and therefore, the dollar value of business interruption is shown as the Direct Industry Value Added in Table 8.1.1.

For every dollar of Direct Value Added lost by the business suffering the fire, there will be indirect impacts of value added lost by the firms supplying goods and services to that business. The extent of this indirect loss of value added is estimated for each industry in the national Input-Output table, and the ratio is called the "value added multiplier" for that industry. We have used these multipliers for each industry and estimate that the total upstream indirect value added lost as a result of these fires is $8.5 million.

As well as the indirect value added lost, there will be a level of income lost by owners and employees in the businesses directly and indirectly affected by the fires. These owners and employees will therefore reduce their consumption levels, which in turn further reduces the level of value added in the economy. This additional reduction is called the Induced Value Added lost. Our estimate is that the Induced value added lost from industrial fires totalled $2.1 million in 2000.

The Indirect reduction in value added of $8.5 million can be combined with the Induced reduction in value added of $2.1 million to give a total indirect (Indirect and Induced) economic impact of $10.6 million from industrial fires in 2000.

Table 8.1.1 Value Added impacts of industrial fires in 2000

VALUED ADDED IMPACTS ($) 2000	**DIRECT** Industry Value Added	**INDIRECT** Upstream Value Added	**INDUCED** Consumption Induced Value Added	**TOTAL INDIRECT AND INDUCED** Value Added
Agriculture	$29,000	$25,000	$6,000	**$30,000**
Services to Agriculture; Hunting and Trapping	$92,000	$58,000	$21,000	**$79,000**
Forestry & Logging	$0	$0	$0	**$0**
Mining	$0	$0	$0	**$0**
Food, Beverage and Tobacco	$258,000	$718,000	$70,000	**$788,000**
Textile, Clothing, Footwear & Leather Mfg	$1,336,000	$3,385,000	$433,000	**$3,818,000**
Wood and Paper Product Manufacturing	$50,000	$75,000	$14,000	**$89,000**
Printing, Publishing and Recorded Media	$0	$0	$0	**$0**
Petroleum, Coal, Chemical & Assoc Prod Mfg	$100,000	$107,000	$24,000	**$131,000**
Non-Metallic Mineral Product Manufacturing	$166,000	$199,000	$43,000	**$242,000**
Metal Product Manufacturing	$15,000	$20,000	$4,000	**$25,000**
Machinery and Equipment Manufacturing	$71,000	$90,000	$21,000	**$111,000**
Other Manufacturing	$68,000	$59,000	$19,000	**$79,000**
Electricity and Gas Supply	$0	$0	$0	**$0**
Water Supply, Sewerage and Drainage Services	$0	$0	$0	**$0**
Food Retailing	$270,000	$172,000	$77,000	**$249,000**
Personal and Household Good Retailing	$464,000	$295,000	$132,000	**$427,000**
Motor Vehicle Retailing and Services	$143,000	$91,000	$41,000	**$132,000**
Accommodation, Cafes and Restaurants	$686,000	$718,000	$180,000	**$898,000**
Transport & Services to Transport	$0	$0	$0	**$0**
Storage and Wholesaling	$3,261,000	$1,986,000	$830,000	**$2,816,000**
Communication Services	$0	$0	$0	**$0**
Business and Financial Services	$827,000	$490,000	$190,000	**$680,000**
Personal and Recreational Services	$0	$0	$0	**$0**
TOTAL	**$7,838,000**	**$8,488,000**	**$2,106,000**	**$10,593,000**

Source: 1996 Intra-industry Study, Interim Survey Panel, BERL

8.2 Impact on Employment

The indirect loss of employment caused by industrial fires can be estimated by the same multiplier method used in the section above. The key difference is that the value added data must be converted into its employment component using the average unit of labour needed to produce one dollar of Direct value added in each industry. This conversion is shown as Direct industry employment in Table 8.2.1. The level of Full Time Equivalent (FTE) employment associated with the level of Direct value added is about 164 FTEs.

For every dollar of Direct value added lost by the business suffering the fire, there will be Indirect impacts upon output and employment by firms supplying goods and services to that business. The extent of this Indirect loss of employment is estimated for each industry using the national Input-Output table, and the ratio is called the 'employment multiplier' for that industry. We have used the employment multipliers for each industry and estimate that the level of Indirect employment lost due to industrial fires is 174 FTE positions.

There will be a level of income lost by owners and employees in the businesses directly and indirectly affected by the fires. These owners and employees will therefore reduce their consumption levels which in turn further reduces output and employment in the economy. This additional reduction is called Induced employment loss. Our estimate is that the Induced employment lost from industrial fires is about 34 FTEs.

The Indirect impact on employment of 174 FTEs can be added to the Induced impact on employment of 34 FTEs to give a total of 209 FTEs as the total Indirect and Induced employment impact of industrial fires. Overall, the total impact on employment includes both the direct and indirect losses, which below is equivalent to 372 FTEs.

The textile, clothing, footwear and leather group records the greatest loss, with a total of 126 Direct and Indirect FTE losses. This group is followed by storage and wholesaling, which records a total of 112 Direct and Indirect FTE losses. Admittedly, the impact on employment in other industries seems relatively low. However, this mostly reflects the fact that the reduction in Direct value added associated with these industries was also relatively low and by association, the level of interruption to output for these industries was also relatively small.

Again, it should be noted that the multipliers provide only a 'big picture' framework for examining of the impact of industrial fires on economic activity and employment. More detail would likely to be forthcoming through case studies and interviews of actual fire incidents, especially those that have had a large or permanent impact upon the region or community in which they occurred.

Table 8.2.1 Employment impacts of industrial fires in 2000

EMPLOYMENT IMPACTS ($) 2000	**DIRECT** Industry Employment	**INDIRECT** Upstream Employment	**INDUCED** Consumption Induced Employment	**TOTAL INDIRECT AND INDUCED** Employment
Agriculture	1	1	0	**1**
Services to Agriculture; Hunting and Trapping	2	1	0	**2**
Forestry & Logging	0	0	0	**0**
Mining	0	0	0	**0**
Food, Beverage and Tobacco	4	13	1	**14**
Textile, Clothing, Footwear & Leather Mfg	44	76	6	**82**
Wood and Paper Product Manufacturing	1	1	0	**1**
Printing, Publishing and Recorded Media	0	0	0	**0**
Petroleum, Coal, Chemical & Assoc Prod Mfg	1	2	0	**2**
Non-Metallic Mineral Product Manufacturing	2	3	1	**4**
Metal Product Manufacturing	0	0	0	**0**
Machinery and Equipment Manufacturing	2	2	0	**2**
Other Manufacturing	1	1	0	**1**
Electricity and Gas Supply	0	0	0	**0**
Water Supply, Sewerage and Drainage Services	0	0	0	**0**
Food Retailing	7	3	1	**4**
Personal and Household Good Retailing	12	5	2	**7**
Motor Vehicle Retailing and Services	4	1	1	**2**
Accommodation, Cafes and Restaurants	19	13	3	**16**
Transport & Services to Transport	0	0	0	**0**
Storage and Wholesaling	54	43	15	**58**
Communication Services	0	0	0	**0**
Business and Financial Services	11	10	3	**13**
Personal and Recreational Services	0	0	0	**0**
TOTAL	**164**	**174**	**34**	**209**

Source: 1996 Intra-industry Study, Interim Survey Panel, BERL

9 SOCIAL COST OF FIRE INJURIES

This section provides an estimate of the social cost of injuries and fatalities associated with all industrial fire incidents. This is achieved by assigning a monetary value to the injury data contained in the *FIRS* database using a methodology developed by the Land Transport Safety Authority (LTSA) to estimate the social cost of road accidents[2]. This methodology includes four elements relevant to fire injuries, as outlined below:

- Loss of life is assigned an average monetary value using the Value of Statistical Life (VOSL). The VOSL is estimated at $2,469,900 in constant dollar terms.
- The average loss of life quality due to serious and minor injuries is estimated by the LTSA to be 10% and 0.4% of the VOSL respectively.
- The loss of output due to temporary disability is assigned a monetary value based on an average number of days off work and the average ordinary time wage rate.
- The average medical cost for injuries with different levels of severity were estimated in 1991 and updated annually using the PPI for health and community services.

Table 8.2.1 shows the average social costs of injury by severity according to the above methodology. Note that the injury categories (non-life threatening, life threatening and fatality) relate to those contained in the *FIRS* database. Thus, it is assumed that these are more or less comparable to those of the LTSA (minor, serious and fatal). The social cost of fatality due to fire injury is valued statistically at $2.5 million in constant dollar terms for 2000. The social cost of life and non-life threatening injuries have been estimated on average at $258,000 and $10,800 in constant dollar terms for 2000.

Table 8.2.1 Average social costs of injuries by severity

AVERAGE SOCIAL COST PER INJURY ($)	Non-life Threatening	Life Threatening	Fatality
Loss of Life (Permanent Disability)	$9,900	$247,000	$2,469,900
Loss of Output (Temporary Disability)	$200	$500	$0
Total Medical Costs:	$700	$10,700	$4,800
Hospital / Medical	$100	$6,700	$2,700
Emergency / Pre-hospital	$500	$800	$2,200
Follow-on	$100	$3,300	$0
Total	**$10,800**	**$258,200**	**$2,474,700**

Source: LTSA

[2] LTSA. *The Social Cost of Road Crashes and Injuries: June 2000 Update*. Sept 2000.

Table 8.2.2 shows the number of industrial fire related injuries that have occurred since 1996. There have been a total of 172 injury incidents since 1996 with a total of three fire related fatalities occurring in 2000.

Table 8.2.2 Number of injuries incurred by year (1996-2000)

NUMBER OF INJURIES	1996	1997	1998	1999	2000	Total
Non-life Threatening	28	41	38	28	25	**160**
Life Threatening	2	2	2	0	3	**9**
Fatalities	0	0	0	0	3	**3**
All injuries	**30**	**43**	**40**	**28**	**31**	**172**

Source: FIRS, BERL

Table 8.2.3 shows the number of injuries occurring by industry since 1996. This pattern appears to show the relationship between the number of fires and the number of injuries as opposed to any correlation between injuries and the type of industry. However, the drought in 1998 appears to have had a noticeable impact in terms of injuries, especially with respect to the agriculture and forestry industry groups.

Table 8.2.3 Total number of injuries by industry

ALL INJURIES AND FATALITIES 1996 - 2000	1996	1997	1998	1999	2000	Total
Agriculture	6	4	12	1	7	**30**
Services to Agriculture; Hunting and Trapping	0	0	1	0	0	**1**
Forestry and Logging	0	0	3	1	1	**5**
Mining	0	0	0	0	0	**0**
Food, Beverage and Tobacco	0	3	0	0	1	**4**
Textile, Clothing, Footwear & Leather Mfg	0	0	0	0	0	**0**
Wood and Paper Product Manufacturing	0	3	0	0	2	**5**
Printing, Publishing and Recorded Media	1	0	0	0	0	**1**
Petroleum, Coal, Chemical & Assoc Prod Mfg	0	1	0	1	1	**3**
Non-Metallic Mineral Product Manufacturing	0	0	0	0	0	**0**
Metal Product Manufacturing	1	0	2	1	0	**4**
Machinery and Equipment Manufacturing	4	7	4	4	4	**23**
Other Manufacturing	0	2	0	0	1	**3**
Electricity and Gas Supply	0	1	0	0	1	**2**
Water Supply, Sewerage and Drainage Services	0	0	1	0	0	**1**
Food Retailing	2	3	2	0	3	**10**
Personal and Household Good Retailing	4	0	2	0	3	**9**
Motor Vehicle Retailing and Services	5	2	0	2	1	**10**
Accommodation, Cafes and Restaurants	2	5	5	7	2	**21**
Transport & Services to Transport	2	5	1	1	1	**10**
Storage and Wholesaling	3	4	3	6	2	**18**
Communication Services	0	0	0	0	1	**1**
Business and Financial Services	0	2	3	4	0	**9**
Personal and Recreational Services	0	1	1	0	0	**2**
TOTAL	**30**	**43**	**40**	**28**	**31**	**172**

Source: FIRS, BERL

Table 8.2.4 shows the social cost of fires over time by assigning a monetary value to the occurrence of injuries outlined above. The social costs were estimated to be $8.5 million in 2000. The social costs in 2000 are substantially higher than those recorded during the previous years due to the loss of life in 2000.

Table 8.2.4 Total social cost of fire related injuries and fatalities

COST OF INJURIES ($)	1996	1997	1998	1999	2000	**Total**
Agriculture	$64,800	$43,200	$129,600	$10,800	$5,250,800	**$5,499,200**
Services to Agriculture; Hunting and Trapping	$0	$0	$10,800	$0	$0	**$10,800**
Forestry and Logging	$0	$0	$32,400	$10,800	$2,474,700	**$2,517,900**
Mining	$0	$0	$0	$0	$0	**$0**
Food, Beverage and Tobacco	$0	$32,400	$0	$0	$10,800	**$43,200**
Textile, Clothing, Footwear & Leather Mfg	$0	$0	$0	$0	$0	**$0**
Wood and Paper Product Manufacturing	$0	$32,400	$0	$0	$269,000	**$301,400**
Printing, Publishing and Recorded Media	$10,800	$0	$0	$0	$0	**$10,800**
Petroleum, Coal, Chemical & Assoc Prod Mfg	$0	$10,800	$0	$10,800	$10,800	**$32,400**
Non-Metallic Mineral Product Manufacturing	$0	$0	$0	$0	$0	**$0**
Metal Product Manufacturing	$10,800	$0	$21,600	$10,800	$0	**$43,200**
Machinery and Equipment Manufacturing	$43,200	$323,000	$43,200	$43,200	$43,200	**$495,800**
Other Manufacturing	$0	$269,000	$0	$0	$10,800	**$279,800**
Electricity and Gas Supply	$0	$10,800	$0	$0	$10,800	**$21,600**
Water Supply, Sewerage and Drainage Services	$0	$0	$10,800	$0	$0	**$10,800**
Food Retailing	$269,000	$32,400	$21,600	$0	$32,400	**$355,400**
Personal and Household Good Retailing	$290,600	$0	$21,600	$0	$32,400	**$344,600**
Motor Vehicle Retailing and Services	$54,000	$21,600	$0	$21,600	$10,800	**$108,000**
Accommodation, Cafes and Restaurants	$21,600	$54,000	$54,000	$75,600	$21,600	**$226,800**
Other transport; Services to Transport	$21,600	$54,000	$10,800	$10,800	$10,800	**$108,000**
Storage and Wholesaling	$32,400	$43,200	$32,400	$64,800	$269,000	**$441,800**
Communication Services	$0	$0	$0	$0	$10,800	**$10,800**
Business and Financial Services	$0	$21,600	$527,200	$43,200	$0	**$592,000**
Personal and Recreational Services	$0	$10,800	$10,800	$0	$0	**$21,600**
TOTAL	**$818,800**	**$959,200**	**$926,800**	**$302,400**	**$8,468,700**	**$11,475,900**

Source: FIRS, BERL

10 TOTAL ECONOMIC IMPACTS

This section summaries the total economic and social costs that have been measured in this study. Note that the material damage and business interruption costs are provisional estimates, but will be refined as and when survey data from the fifth insurance company becomes available. The provisional estimates reported in this study indicate that the total economic impact of industrial fires in New Zealand was approximately $86 million in 2000. Table 10.1 shows the composition of these economic costs.

Total Direct Costs represent the value of economic losses experienced by the industry as a result of the industrial fires and the value of economic resource used in responding to these emergencies. Overall, these direct costs were estimated to be about $67 million in 2000. The total direct costs to industry are estimated using the value of material damage and business interruption insurance claims, with material damage including the damage to structures and buildings. The total value of these insurance claims are estimated to be about $44 million.

The economic resource used in industrial fires represents a share of net expenditure on emergency response services. This share is based upon an allocation framework which estimates the quantum of resources used in industrial fire incidents. The total direct output costs attributed to industrial fires using this allocation framework is estimated to be $23 million.

Total Indirect costs represent the value of economic losses to upstream firms supplying goods and services to the business effected by fire damage, and the resulting decline in consumption that occurs due to the fact that employees and business owners wages and profits are effected by the decline in sales. The economic losses attributable to upstream industries are known as the Indirect impacts, which in this study have been estimated at about $9 million in industry value added (GDP). The economic losses due to the decline in consumption are known as Induced impacts, and have been estimated in this study to be about $2 million. The total Indirect costs of industrial fires are therefore, estimated at about $11 million.

The social costs of industrial fires are estimated by assigning a monetary value to the injuries that occur as a result of industrial fires. These values are based on the Value of Statistical Life (VOSL) measure in New Zealand. The total social costs are estimated at about $8 million in 2000.

Table 10.1 Summary of economic and social costs in 2000

TOTAL ECONOMIC COSTS ($) 2000	**Property Lost**	**Material Damages** [1] (incl property lost)	**Direct Value Added** [1] (business interruption)	**Operational Readiness and Response Costs of NZFSC**	**TOTAL DIRECT COSTS**	**Total Indirect Value Added** (upstream industries)	**Total Induced Value Added** (consumption effects)	**TOTAL INDIRECT COSTS**	**TOTAL SOCIAL COSTS** (injuries)	**TOTAL ECONOMIC AND SOCIAL COSTS**
Primary source of data	FIRS	Survey Panel	Survey Panel	NZFSC		Input:Output tables	Input:Output tables		FIRS	
Agriculture	$1,977,000	$11,842,000	$29,000	$5,350,000	**$17,220,000**	$25,000	$6,000	**$30,000**	**$5,251,000**	**$22,502,000**
Services to Agriculture; Hunting and Trapping	$73,000	$99,000	$92,000	$236,000	**$428,000**	$58,000	$21,000	**$79,000**	**$0**	**$506,000**
Forestry and logging	$0	$0	$0	$321,000	**$321,000**	$0	$0	**$0**	**$2,475,000**	**$2,795,000**
Mining	$117,000	$13,000	$0	$92,000	**$105,000**	$0	$0	**$0**	**$0**	**$105,000**
Food, Beverage and Tobacco	$2,233,000	$350,000	$258,000	$857,000	**$1,465,000**	$718,000	$70,000	**$788,000**	**$11,000**	**$2,264,000**
Textile, Clothing, Footwear & Leather Mfg	$1,487,000	$4,220,000	$1,336,000	$246,000	**$5,802,000**	$3,385,000	$433,000	**$3,818,000**	**$0**	**$9,620,000**
Wood and Paper Product Manufacturing	$822,000	$1,304,000	$50,000	$1,367,000	**$2,722,000**	$75,000	$14,000	**$89,000**	**$269,000**	**$3,080,000**
Printing, Publishing and Recorded Media	$36,000	$113,000	$0	$92,000	**$204,000**	$0	$0	**$0**	**$0**	**$204,000**
Petroleum, Coal, Chemical & Assoc Prod Mfg	$92,000	$485,000	$100,000	$181,000	**$767,000**	$107,000	$24,000	**$131,000**	**$11,000**	**$909,000**
Non-Metallic Mineral Product Manufacturing	$159,000	$2,269,000	$166,000	$228,000	**$2,662,000**	$199,000	$43,000	**$242,000**	**$0**	**$2,904,000**
Metal Product Manufacturing	$167,000	$46,000	$15,000	$312,000	**$373,000**	$20,000	$4,000	**$25,000**	**$0**	**$398,000**
Machinery and Equipment Manufacturing	$647,000	$387,000	$71,000	$789,000	**$1,247,000**	$90,000	$21,000	**$111,000**	**$43,000**	**$1,401,000**
Other Manufacturing	$1,888,000	$768,000	$68,000	$682,000	**$1,518,000**	$59,000	$19,000	**$79,000**	**$11,000**	**$1,608,000**
Electricity and Gas Supply	$8,000	$6,000	$0	$327,000	**$333,000**	$0	$0	**$0**	**$11,000**	**$344,000**
Water Supply, Sewerage and Drainage Services	$0	$0	$0	$78,000	**$78,000**	$0	$0	**$0**	**$0**	**$78,000**
Food Retailing	$1,604,000	$1,424,000	$270,000	$1,194,000	**$2,888,000**	$172,000	$77,000	**$249,000**	**$32,000**	**$3,170,000**
Personal and Household Good Retailing	$2,559,000	$3,048,000	$464,000	$2,050,000	**$5,561,000**	$295,000	$132,000	**$427,000**	**$32,000**	**$6,021,000**
Motor Vehicle Retailing and Services	$651,000	$513,000	$143,000	$1,289,000	**$1,946,000**	$91,000	$41,000	**$132,000**	**$11,000**	**$2,088,000**
Accommodation, Cafes and Restaurants	$3,419,000	$4,171,000	$686,000	$1,925,000	**$6,782,000**	$718,000	$180,000	**$898,000**	**$22,000**	**$7,701,000**
Transport & Services to Transport	$166,000	$192,000	$0	$967,000	**$1,159,000**	$0	$0	**$0**	**$11,000**	**$1,170,000**
Storage and Wholesaling	$2,461,000	$1,310,000	$3,261,000	$2,163,000	**$6,735,000**	$1,986,000	$830,000	**$2,816,000**	**$269,000**	**$9,820,000**
Communication Services	$148,000	$0	$0	$369,000	**$369,000**	$0	$0	**$0**	**$11,000**	**$380,000**
Business and Financial Services	$835,000	$3,225,000	$827,000	$1,734,000	**$5,786,000**	$490,000	$190,000	**$680,000**	**$0**	**$6,466,000**
Personal and Recreational Services	$525,000	$360,000	$0	$405,000	**$765,000**	$0	$0	**$0**	**$0**	**$765,000**
TOTAL MARKET ESTIMATE ($)	$22,072,000	$36,145,000	$7,838,000	$23,253,000	**$67,236,000**	$8,488,000	$2,106,000	**$10,593,000**	**$8,469,000**	**$86,298,000**
IMPACT ON EMPLOYMENT (FTEs)			164		**164**	174	34	**209**		**372**

Source: BERL

11 WHERE TO FROM HERE

This study represents one of the first attempts at measuring the impact of industrial fire incidents in New Zealand. As such, it provides a benchmark of the size and composition of economic costs associated with industrial fires.

Thus, the findings from this research could be used for a number of purposes including assisting the Fire Service to 'target' its efforts in minimising the costs of industrial fires, or in assisting further research. In this respect, the research has highlighted a number of industries both within certain regions and on a nationwide scale which appear to warrant further investigation through case studies. Also, it should be noted that the EIA provides an 'overview' of the economic costs but it is not a comprehensive tool, especially in cases where the fire has a substantial impact upon small communities. In such cases, the assessment of these impacts would again need to be made on a case study basis.

This research shows that the insurance claims database that has been developed for the Economic Impact Assessment can be used to infer business and economic information on the costs of industrial fires, which in turn, can be used to enhance the wealth of incident-specific information contained within the FIRS database. This information can therefore, be used in ongoing research into industrial fires.

The research also develops a broad framework for allocating the resources used by the Fire Service. This framework could be developed further in subsequent research and be applied to a wide range of operational issues. Within the context of the current research, this framework highlighted a number of features including the fact that a large number of incidents are in fact false alarms and that while industrial fires account for just 5% of all incidents, they use a disproportionately large amount of the total resource. While it is clear that the Fire Service must retain sufficient capacity to fight large (industrial) fires, what are the implications for the Fire Service and the economy in terms of a long-term reduction in such incidents? Indeed, what sort of impact would an improvement in fire detection or control systems have upon the economic costs measured in this report?