Fire Research Report

Developing a Composite Performance Measure for the New Zealand Fire Service

BERL

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Consideration is given to how the community might satisfy itself that a fire and rescue service, specifically the New Zealand Fire Service, is maintaining its capability and readiness to respond to all reasonable emergencies. A fire and rescue service is a 'standing force' of firefighters and equipment and the resources devoted to these are in the main independent of the number of incidents attended. An ideal composite performance model is developed which incorporates weighted measures of the readiness and capability of the human and capital resources into a single index measure. Consideration is also given as to how the weightings might be determined and a working model is built using a mix of available and dummy information.

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Report to:

New Zealand Fire Service

DEVELOPING A COMPOSITE PERFORMANCE MEASURE FOR THE NEW ZEALAND FIRE SERVICE

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Developing a Composite Performance Measure for the NZFS

1 Executive summary

This report arises from a New Zealand Fire Service (NZFS) Contestable Research Fund project to explore the key elements of a new performance measure for NZFS activities. In particular, the research investigated the development of a composite performance measure (CPM) designed to provide an indication of the capability and readiness of the NZFS.

Many, if not most, of NZFS costs are unrelated to the number of incidents attended. In this context, a capability and readiness measure is an appropriate companion to the conventional costs-per-service financial based measures.

Business and Economic Research Limited (BERL) has developed a CPM that consists of three sub-components. These sub-components are people, equipment and processes.

The sub-components people and equipment are indicators of the readiness and capability of the human and capital resources of the NZFS, while processes include the procedures, policies and personnel that the NZFS has in place. Each sub-component has a weight in the CPM, with the weights reflecting the relative importance of each sub-component in determining overall capability and readiness. Within each sub-component we include several individual indicators, with each indicator being similarly assigned a weight.

BERL has defined the capability and readiness of the NZFS as their ability to complete tasks efficiently and be prepared to fight fires and other emergencies. Capability and readiness is the key determinant of the CPM. As alluded to above, the NZFS provides a 'standing force' of firefighters and equipment and the resources devoted to these are in the main independent of the number of incidents attended. We avoid using indicators already included in specified annual performance targets, preferring indicators that closely signal the capability and readiness status of the NZFS.

This report contains an ideal and a working CPM. The ideal CPM assumes that all the required information is available, while the working CPM includes some fictitious (or dummy) data to indicate how it could be used annually to measure capability and readiness and compare results year-on-year. The dummy data also highlights indicators we believe would be useful in the CPM.

2 Introduction

The purpose of this research is to develop a single measure that provides communities and national stakeholders with assurance that the NZFS is capable and ready to respond to emergency incidents within parameters that reflect community expectations and the National Commander's published performance targets.

Section 3 outlines the role, size and organisational structure of the NZFS, as well as how the NZFS is funded.

In Section 4 we discuss the need to measure the capability and readiness of the NZFS given the performance targets already in place. This section outlines the need for the NZFS to provide a standing force of firefighters to respond to fires and/or other incidents and the community expectations that surround the NZFS. It defines capability and readiness in regards to the NZFS, arguing the capability of the NZFS as their ability to complete tasks efficiently and the readiness of the NZFS as being prepared to fight fires and other emergencies. These definitions are supported by our literature search.

Section 5 turns to measuring the capability and readiness of the NZFS and proposes ideal sub-components and indicators for the CPM. This section discusses how BERL chose the sub-components and indicators, and the steps we took in this decision-making process. From four potential sub-components BERL refined the CPM to three sub-components – people, equipment and processes – and allocated weightings to each of these sub-components. Within the sub-components we weighted the indicators, which are posed as questions.

In this section of the report we argue that an ideal measure of the capability and readiness of the NZFS would have an indicator reflecting each of the questions. However, difficulties in obtaining relevant information or measurements means some questions in the ideal CPM are difficult to answer.

As such, section 6 contains a practical working CPM and poses questions where indicators are currently measurable and obtainable. In section 6, the data values presented for each year in the CPM are mostly dummy data for illustrative purposes. This section of the report therefore provides a working example of the proposed CPM.

Finally, section 7 sets out several recommendations for the NZFS going forward.

3 The New Zealand Fire Service

This section of the report profiles the NZFS. It discusses the role, funding and organisational structure of the NZFS.

3.1 Profile of the NZFS

The NZFS Commission provides, on behalf of the Government, a range of fire risk reduction, fire safety, and emergency response services to the community.

The Commission was established and is funded under the Fire Service Act 1975. It is responsible for the good governance and control of the NZFS, and the National Rural Fire Authority under the Forest and Rural Fires Act 1977.

This report focuses on the capability and readiness of the NZFS to reduce the incidence of fire, and excludes the National Rural Fire Authority who is responsible for the coordination and administration of rural fire policy and operations.

3.2 Role of the NZFS

The principle role of the NZFS is to reduce the incidence of fire and its consequences for people, property, the community, and the environment. In the 2006/2007 year, the NZFS responded to 71,690 emergency incidents. These incidents can be broken down into the following categories:

Category	Number of incidents in 2006/07 year
Fires	25,181
Hazardous emergencies	3,291
Medical emergencies	4,385
Motor vehicle incidents (excluding fires)	5,821
False alarms	26,482
Other emergencies	6,530

However, the NZFS is attending an increasing proportion of non-fire related incidences. In 2006/07, for example, 29 percent of incidents were non-fire related emergencies compared to 24 percent in 2000/01. The number of natural hazard incidents the NZFS responds to is

also increasing. These incidents arise from severe weather causing flooding and damage to property and infrastructure such as roading. The NZFS plays a key role in providing an initial response to these types of incidents and assists in the cleanup that many communities go through after a natural disaster.

3.3 Funding the NZFS

The NZFS is funded by the fire service levy. Section 48 of the Fire Service Act 1975 requires insurance companies, insurance brokers, parties that self insure, parties that insure property located in New Zealand and offshore, and certain others to collect a levy on all contracts of fire insurance, and to remit this to the NZFS Commission. The levy rate is reviewed annually by the Minister of Internal Affairs, and the levy is payable on all insurance contracts covering New Zealand property against loss from fire.

The provision of fire services such as the costs of career and volunteer firefighters, fire stations, appliances, and other equipment are the major costs associated with fire risk management. In addition, not all fire service activities are related to fire risk management because the NZFS also responds to incidents such as hazardous material spills, earthquakes, and floods.

The NZFS needs to operate within the budget determined by levy collections. This operation includes meeting the National Commander's public performance goals and responding to incidents in a way that reflects community expectations of the NZFS.

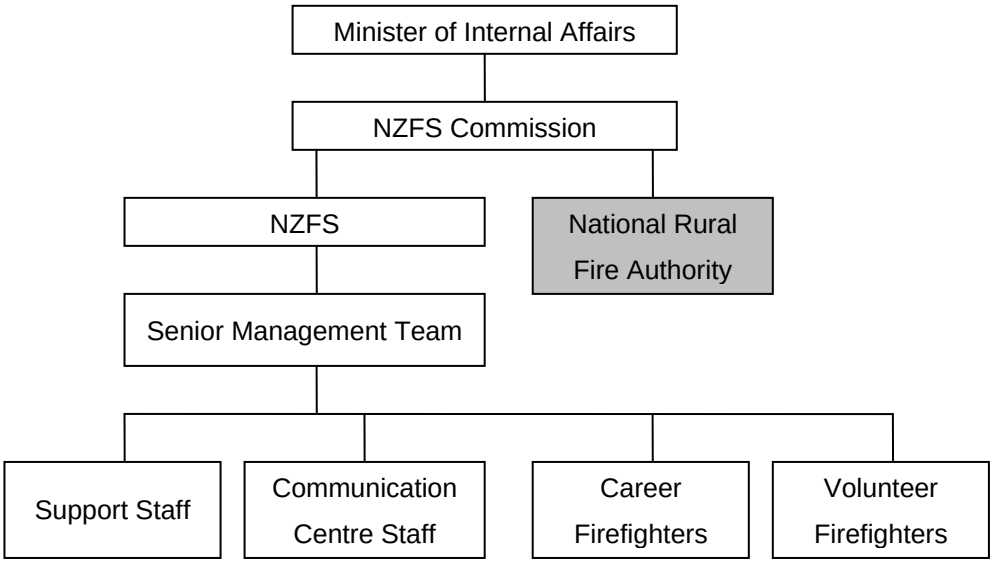
3.4 Organisational structure of the NZFS

Staff in the NZFS can be broken down into career firefighters, volunteer firefighters, communication centre staff, and management and support staff. This report focuses on the capability and readiness of career and volunteer firefighters.

There are approximately 1,700 career firefighter and 7,000 urban volunteer firefighter positions in New Zealand. These firefighters work at fire stations within fire districts. New Zealand currently has 346 urban fire districts, 440 fire stations and approximately 960 fire appliances.

Figure 3.1 presents the structure of the NZFS.

Figure 3.1 Structure of the NZFS



As the NZFS is funded by the fire service levy, and because it provides fire risk reduction, fire safety and emergency response services on behalf of the Government, it has to set and meet strategic objectives that are linked to a high standard of service. These strategic objectives provide the NZFS with a strategic direction and strategic plan. But, as we will discuss in the following section, setting and achieving performance targets does not necessarily or directly measure the capability and readiness of the NZFS to respond to emergency incidents.

4 Why measure capability and readiness?

This section discusses the need to measure the capability and readiness of the NZFS. It discusses the performance targets of the NZFS, the need for the NZFS to provide a 'standing force' of firefighters to respond to fires and/or other incidents, community expectations around the need for a 'standing force', a definition of capability and readiness, and a brief review of international literature on capability and readiness.

4.1 The performance targets of the NZFS

In their annual reports, the NZFS sets out how they have performed over the past year across a range of strategies and programmes. These strategies and programmes, as mentioned in the previous section, are designed to meet the role the NZFS has and the services they provide on behalf of the Government. Four key indicators are used to monitor the performance of the NZFS. These are:

- Avoidable residential fire fatalities
- Fire injuries to the public
- Fires in structures
- Hectares lost to wildfire.

These indicators allow the NZFS to measure their performance and compare such performance with those of previous years. However, they do not indicate the need for the fire service to operate a standing force of firefighters or the capability and readiness of this force.

4.2 A 'standing force' ready and capable to respond

From an economic perspective, the characteristic of a 'standing force' facility is the large element of fixed costs. Consequently, there is a large difference between the average cost of each unit of service delivery and its marginal cost. For the NZFS for example, taking one incident as a measure of a unit of service delivery, the average cost of attending an incident is relatively high compared to the marginal cost of attending the next incident.

Further, the number of incidents attended does not change the average cost that much. This feature makes the performance measures focussing on incident numbers or service delivery indicators less informative when attempting to infer a 'value for money' concept. Thus

directly measuring capability and readiness may provide a better indication of 'value for money'.

Operating within a set budget, fire services are required by communities to reduce the incidence and consequences of fire. To reduce the risk of fire, fire services and the communities they serve require firefighters to be available as a 'standing force' to fight fires. Increasingly, fire services are also required to provide assistance to other emergency response services at incidents such as road accidents or civil defence emergencies.

Most fire services are provided by the public sector; and in New Zealand these services are delivered by the NZFS and the Rural Fire Authorities. There are also a number of private fire services that operate within the New Zealand forest, air transport, and manufacturing industries. The NZFS and the Rural Fire Authority career and volunteer firefighters are the 'standing force' capable and ready to respond to emergency incidents.

4.3 Overview of community expectations

As mentioned in section 3, communities require fire services to reduce the incidence and consequences of fire. One way the NZFS does this is by working with the community to protect what they value. Working with the community is also expressed as one of the five key values of the NZFS. This value states:

We serve our communities and retain their trust and confidence by understanding what they value and going the extra mile to meet their needs. We deliver on our commitments and can be relied upon.

As well as reducing the incidence and consequences of fire, the NZFS responds to other emergencies. For example, the NZFS plays a key role in emergency management when natural hazards such as flooding occur. This often involves coordinating with other community and civil defence groups, and works in with the vision of the NZFS to work with communities to protect what they value. Communities turn to the NZFS to help them protect life and property, and this expectation stems from the visible role the NZFS plays in communities.

The NZFS is part of the community, particularly in small towns, and firefighters contribute to community life through fairs and fundraising particularly in community-based promotions such as home fire safety visits, promotions at home shows and fairs, and attending fire safety promotion campaigns in schools. The community expects that the fire service are capable and ready to fight fires as they have seen the equipment and their training in action at local school fairs and home shows.

The NZFS has recognised the role they play in the community. For example, the theme 'Local Delivery – National Organisation' in their 2007 annual report underscores the point that, with few exceptions, all NZFS services are delivered locally. While this report does not evaluate the effectiveness of this type of involvement in the community, it does analyse community expectations that surround the capability and readiness of the NZFS.

4.4 Definitions of capability and readiness

The purpose of this project is to develop a measure that will enable communities and stakeholders to assess whether "the Fire Service was capable and ready to respond to emergency incidents within parameters that reflect community expectations and the National Commander's published performance goals".

According to the Oxford English Dictionary, capable means 'able to achieve efficiently whatever one has to do' while ready means 'prepared for an activity or situation'. In regards to the NZFS, we have taken these definitions and defined the capability of the NZFS to be the ability of the fire service to complete their tasks efficiently and the readiness of the NZFS to be prepared to fight fires and other emergencies.

4.5 Literature search

As part of developing the CPM, BERL searched international literature on emergency response services to determine if any other countries had developed a measure that focused on capability and readiness.

We based this literature search on the assumption that in most countries the emergency response to accidents and natural disasters is very dependent on a trained workforce of emergency service workers.

We restricted our search to English-speaking countries, and were particularly interested in countries that had similar emergency response services to New Zealand, which would allow us to easily compare the situation with the NZFS. As such, most references found in our literature search were to the fire service or emergency response services in the United States, the United Kingdom, and Australia.

What we found from our literature search is that most international literature, particularly literature that discussed fire services, discussed the role and performance of the emergency response service. Performance measures of these emergency response services were often determined by the statutory role and budget of the organisation, and focused on outputs. These performance measures were often used to measure past performance and to set future performance goals.

Literature that focused on the role of the fire service or emergency response service discussed the need for adaptability. The Atkinson Review was an independent review of the United Kingdom fire service completed in 2002. Literature on the Atkinson Review provided useful information on the role of the fire service in the United Kingdom as well as on the need for the fire service to adapt to managing the risk of fire rather than responding to incidents.

Other literature from Australia, particularly from the state fire services and fire brigades, emphasised the need for the fire service to be flexible to meet current and emerging needs in the community. This literature discussed having confident and competent staff to meet challenges and ensuring the fire service had the capacity and capability to meet an emergency response. However, it did not measure this capability or discuss how capability and capacity could be measured and used to determine whether or not performance goals were being met.

Literature that focused on the performance of the fire service or emergency response service discussed performance measures and readiness. However, the literature that discussed readiness focused more on the readiness of a community to deal with fires and incidents.

A publication from 2006 discussed and ranked the performance of emergency response services. This publication by the National Association of State EMS Officials and EMS Physicians presented the results of a 200-city survey of emergency medical services in the United States. Again, this publication focussed on performance results rather than readiness to perform.

One example of a publication that discussed community readiness is a publication jointly produced by the Victorian fire services in Australia entitled 'Fire Ready Victoria Strategy 2004-2007'. This publication was part of a three year strategy to increase awareness of the risk of bushfires and prepare Victorian communities for bushfires.

Publications that looked at the readiness of the fire service were concerned with whether the fire service had plans in place to respond to a fire or incident. For example, the Atkinson Review mentioned earlier discussed the need to have systems in place to deploy people and equipment to deal with fires in the most cost-effective way. From the Atkinson Review came another paper by the Office of the Deputy Prime Minister (2005). This paper set up a framework to examine the key issues in measuring the output and productivity of the Fire and Rescue Service. This paper assessed current performance measures and identified several issues including the difficulties of using volume measures when examining the key activities of the fire service, and the problems associated with capturing the effectiveness of fire prevention work and attending fewer fires. The focus of this review was measuring

outputs and weighing these together to produce an index for the Fire and Rescue Service. While providing a useful discussion on the issues associated with performance measures, this framework focuses on volume of activity rather than capability and readiness to perform the activity.

Other publications that looked at the readiness of the fire service were concerned with the efficiency and productivity of the fire service, and the problems associated with measuring outputs. Jaldell (2005) discussed efficiency and productivity studies in the private sector, using the example of the problems associated with measuring outputs in the fire service. Neely et al (1997) looked at the development of performance measurement systems across industries. This article argued that the problem with existing systems was their reliance on traditional cost accounting principles. Neely et al (1997) argued that what is needed when measuring performance is ratios and a focus on improvements, as opposed to absolute numbers.

Finally, international literature that analysed fire statistics and fire research also discussed volume, comparing statistics between years as a measurement of performance as opposed to capability and readiness. This literature discussed the number of fires attended, the number of injuries and deaths caused by fire, the types of fires attended and the causes of fire, as well as the costs of fire such as property losses, insurance coverage, and the cost of supporting a fire service. As such this literature did not provide a comparable measure for this study.

Very little literature was found on the justification for firefighters to be available as a 'standing force' to fight fires. Some literature discussed the increasing need for firefighters to be available to respond to the threat of terrorism, but these articles focused on how to handle this type of situation rather than how to measure the response of the fire service to this incident. Similarly, articles on biosecurity and biosecurity threats focused on what steps should be put in place to handle a biosecurity threat and how to handle the situation rather than how to measure the response.

Closer to home, the New Zealand Veterinary Association (NZVA) is looking to develop a New Zealand Veterinary Reserve similar to that operated in Australia and Canada. This reserve would be a standing force of rural veterinarians ready to promptly handle emergencies such as an outbreak of foot and mouth disease. To develop this standing force, the NZVA looked at the public good benefits of having a standing force, the capability of rural vets, and what would be required for rural veterinarians to promptly handle any likely emergencies.

4.6 Why measure capability and readiness?

After discussing the role of the NZFS, defining capability and readiness in regards to the NZFS, and examining international literature that discusses performance measures rather than capability and readiness, we have concluded that conventional performance measures are inadequate to measure the capability and readiness of the NZFS. The NZFS provides a 'standing force' of firefighters irrespective of the number of incidents they attend annually.

As such, the three sub-components we have used to devise a composite measure of the capability and readiness of the NZFS are people, equipment, and processes. People and equipment reflect the readiness and capability of the human and capital resources of the NZFS, while processes include the procedures, policies and personnel that are in place. How we decide on individual indicators within these sub-components is discussed in the next section.

5 Measuring capability and readiness

This section outlines the concepts and methods behind creating a composite performance measure for the NZFS. It describes an ideal measure of capability and readiness, assuming that perfect information is available. Section 6 continues this discussion, illustrating what the CPM could look like using information that is available and dummy variables.

5.1 Initial measures of capability and readiness

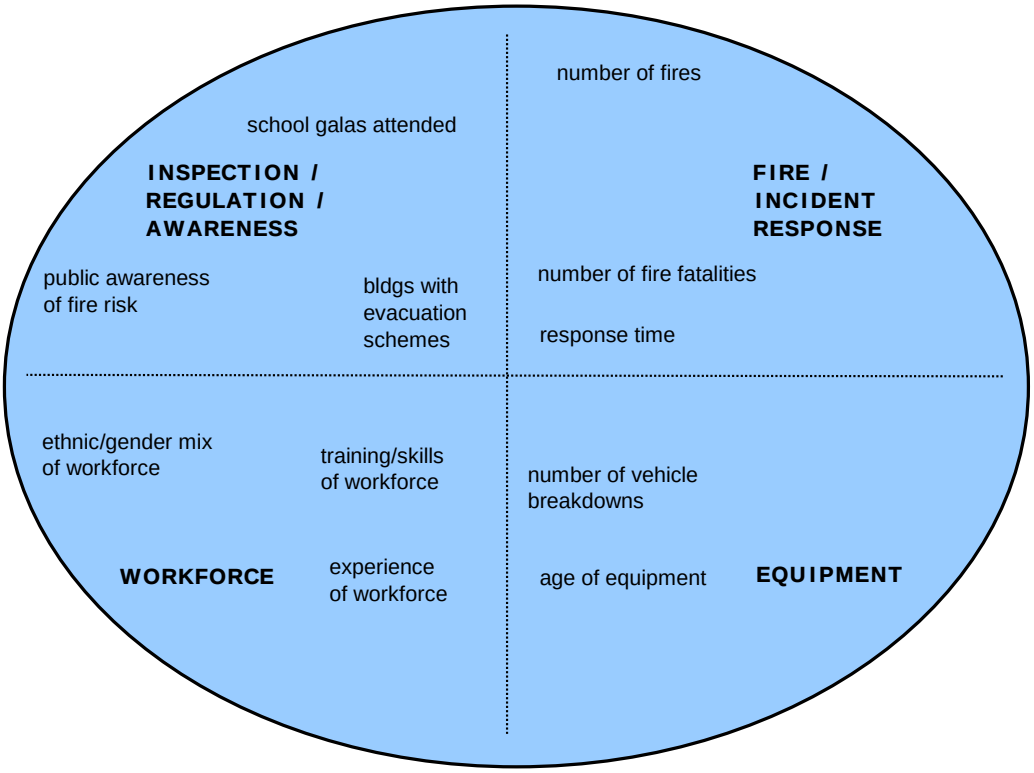
Potential sub-components and individual indicators for a CPM were initially identified through a series of workshop sessions within the project team and meetings with the NZFS. These sessions examined NZFS data and information, and international literature that was located as part of a literature search. Key words used in the literature search provided anchor points under which various thoughts and ideas were hooked. These anchor points were represented by circles as we recognised fairly early in our research that the role, function and performance goals of the NZFS were not mutually exclusive. The use of key words and circles meant the sub-components and indicators could then be broken down, added to, or grouped together, providing a broad-based flexible approach to our research. At this point, capability and readiness were considered a subset of performance measures.

This initial work resulted in a framework document delivered to the NZFS. This document discussed the range of measures that could be used to create a wider overall performance index as well as measures that specifically measured capability and readiness. Various questions and issues were included in this document, and from it and further discussions, a clearer set of indicators emerged.

Figure 5.1 below illustrates the sub-components broken down to represent the 'standing force' of the NZFS. Each sub-component includes a broad grouping of related indicators. All indicators identified in the initial work on this project were attributed to one sub-component.

The sub-components 'inspection/regulation/awareness' and 'fire/incident response' contain indicators that reflect NZFS responsibilities under the Fire Services Act 1975. These performance measures are output measures in the sense that they are measuring the results of all the NZFS resources coming together to put out a fire, or resolve an incident. As such these sub-components could be considered performance indicators.

Figure 5.1 Potential Sub-Components of a CPM



Looking at the sub-components in more detail, the 'inspection, regulation and awareness' sub-component includes indicators that measure the role the NZFS plays in public education and raising public awareness about fire prevention and fire safety. These indicators could include increasing public awareness of fire risk, checking buildings have fire evacuation schemes, and practise evacuations.

Indicators within this group support the principle role of the NZFS to reduce the incidence of fire, and are similar to those discussed in the literature search. Findings from our literature search, however, focussed on the NZFS having plans in place to respond to a fire or incident. But the Atkinson Review of the UK Fire service completed in 2002 did note the need to manage the risk of fire rather than respond to it, and this appears to be the current focus of the NZFS.

The 'fire/incident response' sub-component measures how well the NZFS responds to fire incidents. Indicators in this group could include the number of fires annually attended, the speed of response to a fire and/or incident, and the effectiveness of firefighters in preventing injuries, deaths and damage as a result of fire. Indicators within this group are currently used by the NZFS to measure past performance and set future performance goals.

However, the 'workforce' and 'equipment' sub-components contain indicators that can influence or even determine NZFS performance. That is, these sub-components are input-based measures that look at the underlying factors that indirectly impact on NZFS performance.

The 'workforce' sub-component includes indicators that measure the training, experience, and size of the NZFS workforce. These indicators could include years in service and number of training courses passed. They can also include indicators that reflect the diversity of the workforce, their training needs and the degree to which they are representative of the communities they serve.

The 'equipment' sub-component measures the effectiveness and reliability of equipment used by the NZFS, such as fire appliances and safety gear. Indicators within this sub-component could include the number of appliance breakdowns or the age or condition of the equipment.

5.2 Input-based capability and readiness

As mentioned in the previous section, from these potential sub-components and indicators and further discussions with the NZFS, a clearer set of indicators emerged.

5.2.1 Capability, readiness, and the standing army

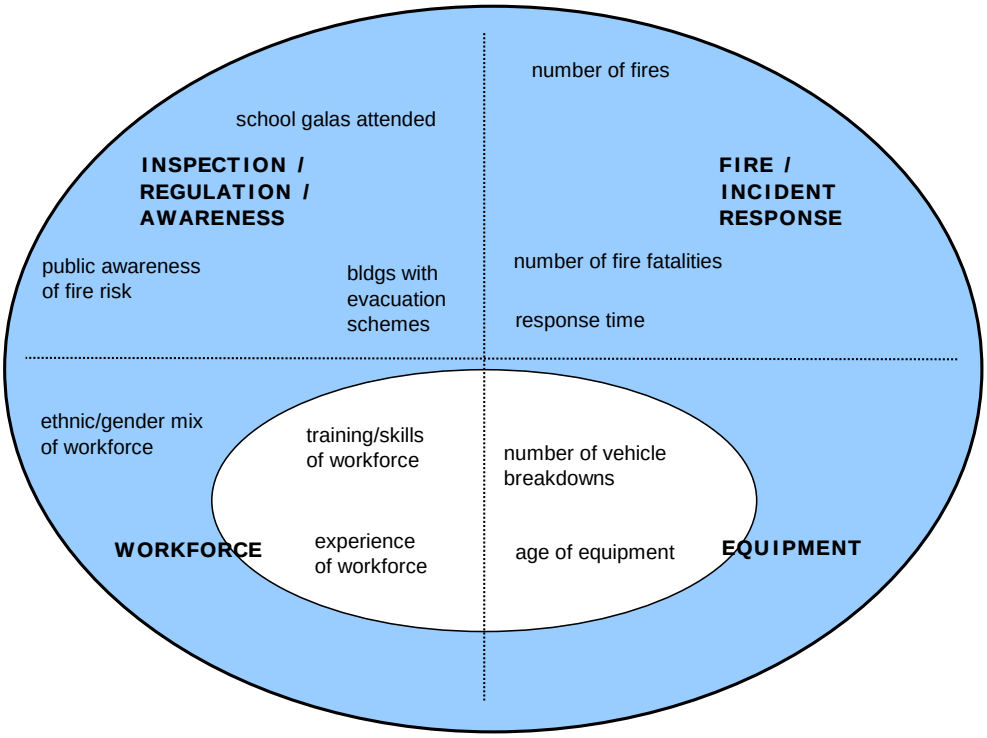
A key step in determining the makeup of the CPM was to clarify its scope. The NZFS expressed a strong desire to move away from a definition of capability and readiness that would include performance. Annual performance targets are already set and measured by the NZFS, and using them in a CPM would be reworking existing information.

NZFS annual performance targets are effective in measuring the operation of the fire service, but may not be showing the whole picture in terms of the capability and readiness of this 'standing force'. The personnel in a standing army have to be capable and ready to meet the challenges of a situation irrespective of whether an incident occurs. Their equipment and appliances must continue to be maintained.

In keeping with this view, BERL included sub-components and indicators that go into preparing and maintaining a 'standing force', and hence the capability and readiness of the NZFS. As such, this study breaks away from the traditional output-based performance measures that are used internationally and by the NZFS, and takes an input-based approach.

For this reason, BERL has included in the CPM the sub-components of workforce and equipment, and excluded the sub-components inspection/regulation/awareness and fire/incident response. Figure 5.2 depicts the indicators that would be included in an input-based CPM as a subset of various NZFS related measures.

Figure 5.2 An input-based CPM as a subset of wider group of indicators



Above the horizontal line are essentially output-based measures, while below the line are input-based measures. Those within the internal unshaded area are representative of those to be included in an input-based CPM. This group is a subset of the total input indicators because there are indicators within the workforce and equipment sub-components that do not necessarily measure capability and readiness. A key example of this is the ethnic or gender mix of NZFS employees. While this is part of the NZFS performance targets, the indicator has no bearing on the capability and readiness of the NZFS.

5.2.2 Process and the Nertney Wheel

A third sub-component, labelled process, was added to the CPM along with the workforce and equipment sub-components. This inclusion followed due deliberation and feedback from operations, training and other staff from the New Zealand Fire Service.

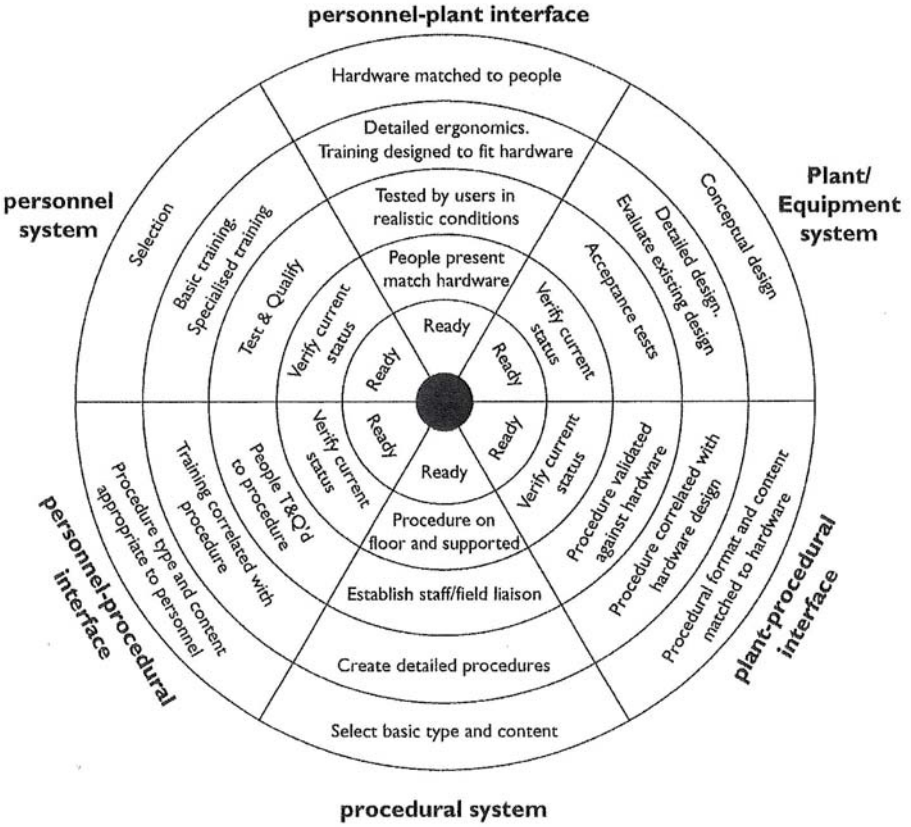
The process sub-component incorporates the procedures and policies that personnel follow in all situations. These procedures and policies are the methods the NZFS uses to

effectively employ the human (people sub-component) and capital (equipment sub-component) resources to perform the jobs required of them.

Process is also included along with people and equipment in an operational readiness system model used by the NZFS Operations and Training team. That team's definition of operational readiness closely matches our definition of capability and readiness as defined in section 4. Therefore, it is reasonable to suggest that the standards manual being developed by the Operations and Training team and the CPM are consistent.

The model used by the NZFS is called the Nertney Wheel.[1] This model uses the elements of people, plant/equipment, and procedures/management controls as the three aspects of operational readiness.

Figure 5.3 The "Nertney Wheel" Developmental Model of Operational Readiness



Effectively, process is the glue that holds together the other two inputs. It can be argued that, without proper processes, the appropriate personnel and equipment of the NZFS cannot be brought together in response to an incident. For example, at an incident who decides how

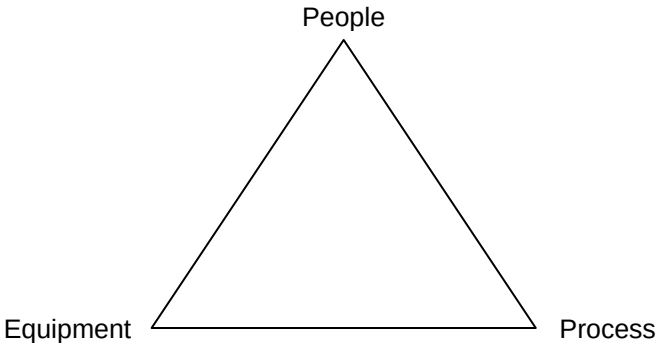
[1] Nertney, R.J. (1987). Process Operational Readiness and Operational Readiness Followon. US Department of Energy, Ref. DOE 76-45/39, SSDC-39.

many firefighters and which fire appliances should be sent to respond? Ideally, this would be answered using pre-determined policy and processes to ensure the personnel and equipment are efficient and effective.

5.2.3 Three sub-component capability and readiness model

With the inclusion of process as a sub-component of the CPM, the input sub-components can now be represented as points on a triangle.

Figure 5.4 NZFS capability and readiness model



5.3 A stylised CPM

Having selected the sub-components, we will now turn to the indicators within each sub-component. The indicators are represented as questions. The questions are an ideal measure of capability and readiness that the NZFS should try to answer, given complete and accurate information on all aspects of its function. The questions take a high-level theoretical approach and do not focus on the specific details of the indicators.

Practical, detailed indicators are covered in section 6. However, these practical detailed measures do not provide all the answers to the questions posed in this section, because of difficulties in measurement and the availability of information.

5.3.1 People

An ideal indicator in the CPM that measures people should try to answer the following questions:

1. Are staff adequately trained to an appropriate level to do their job?
    a. Are they prepared to respond to fires and other emergencies?
    b. Are they able to complete their tasks efficiently?
2. Is the training suitable in terms of:

a. The quality and/or effectiveness of the training?

b. The frequency of the training?

3. Are there sufficient trained staff to adequately perform NZFS tasks?

Question one asks: if a person completed training would they be able to perform their role effectively? This question assumes that training courses match job descriptions and are adequate to produce capable firefighters. One thing this measure does not reveal is a decline in the quality of NZFS training courses. Presumably, if this occurred the capability and readiness of the NZFS would fall, but this change would not necessarily be picked up by this question. This is because question one uses completed training courses as a proxy for measuring the practical skill levels of NZFS staff. Measuring practical skill levels, such as how many career firefighters know what to do in a given situation, or how many career firefighters are capable of handling certain equipment, is difficult due to the levels of training and responsibility within each role.

An alternative approach, as described in question two, attempts to estimate the quality and effectiveness of the training. However, this may be difficult to measure because of the subjective nature of quality and effectiveness. One way to identify training quality is to look at the results produced by people trained, but this goes back to an output-based approach. Instead, an independent review that compares quality of training between years is probably the best way to determine this. But difficulties arise here as well in terms of what factors to compare, and how these factors can be recorded as figures that can be compared year-on-year.

Another measurement approach is frequency of training, although it will already be measured in question one from a different direction by having inadequate training. Training must be scheduled, and completed before a person is qualified. A frequency perspective would look at the number of staff that are waiting to complete training. This indicator would therefore be a subset of those who failed question one.

Question three highlights the need for adequate numbers of trained staff to complete NZFS tasks and duties. Irrespective of training, without adequate numbers of staff it is unlikely the NZFS would be fully capable and ready. This indicator would examine each station and ask whether there is enough staff to perform the tasks and duties of the NZFS. This indicator could be measured using existing policy as a baseline; for example, if a fire appliance is unable to leave a station unless there are four firefighters on board then the measure would be, are there enough staff employed (permanent or voluntary) to support this policy? This measure assumes that current policy reflects the capability and readiness of the NZFS. And

ideally this measure would include not only firefighters, but also office and support personnel and any others that have an impact on the day-to-day running of the NZFS.

5.3.2 Equipment

An indicator in the CPM that measures equipment should try to answer the following questions:

1. Is current equipment adequate in terms of being:
    a. Fit for purpose?
    b. Reliable?
2. Does the NZFS have sufficient equipment to perform their duties?
3. Is the NZFS keeping track of and incorporating new technology and improvements into their equipment as they become available?

Question one measures the current performance of NZFS equipment. Fit for purpose is important; if a piece of equipment is high quality and does not break down but it does not do the job asked of it, then this is an equipment failure and should be measured.

How to measure fit for purpose is difficult and subjective, in the sense that an expectation must be made as to what each piece of equipment should do. Something similar to a standards guide could be used as a base for this measure, comparing approved expectations for each piece of equipment with its actual performance. A pass/fail process could be completed, with the number of fails counted and compared year-to-year.

Equipment reliability is more straightforward. Whether there are appliance breakdowns or other malfunctions with handheld or safety equipment, counts can be made of such failures and tallied annually. A weighting of relative importance could be used on each piece of equipment, as the failure of some equipment may not be as crucial as others.

Question two asks: is there enough equipment, irrespective of its quality, to complete the task? This measure could be counted by looking at reports of problems caused by a lack of equipment.

In question three the measure considers technology. While equipment may be maintained and there may be adequate equipment to do the job, it is possible that a better job could be done if new technology was used. However, it is difficult to measure this indicator as it would require an estimate of the quality of the equipment. Many new technologies will not

cause a real improvement in the results. For example, an improved pump may have a longer life span or be more water efficient, but it may not increase the rate at which a fire is put out.

There are several ways that quality of equipment could be measured:

- Specific results from the NZFS could be used as a proxy for the quality of the equipment. However, this uses an output-based approach that has problems associated with it, as outlined in the appendix.

- Estimates could be used such as an estimate on the number of equipment failures. This gives an idea of the reliability of the equipment, but it does not incorporate all aspects of quality, such as how efficiently the equipment completes its required task. Also, an estimate of equipment quality will not keep track of quality improvements, unless the measure is benchmarked using a required improvement each year. For example, if analysis shows that the quality of international fire service equipment is increasing by 5 percent every year, then the NZFS could benchmark the necessary improvement in their equipment quality at 5 percent.

- Independently test all equipment using a comparative variable; for example, when measuring pumps compare the volume of water each pump pumped per second. In many cases multiple variables could be looked at such as effectiveness and reliability. In this way individual scores could be attributed to each type of equipment, which could then be averaged and compared to previous years results. Practically, measuring equipment quality this way is likely to be infeasible given the sheer volume of information required.

5.3.3 Process

An indicator in the CPM that measures process should try to answer the following questions:

1. Are there policies or processes in place for every situation the NZFS comes across such as:
    a. Scheduled maintenance and day-to-day processes?
    b. Fires and other incidents?
2. Are the policies or processes in place effective in all situations?

If current policies or processes do not include every eventuality that could occur, they should be added to. Further, if policies or processes are not effective - for example, adherence to a certain policy leads to additional damage that should have been avoided – then the process or policy should be changed.

Ideal measures of policy or process should look at all policies or processes currently in place in the NZFS. A count should be made of all situations for which no policies were relevant or useful, and another count should be made of process failure where processes failed to get the desired result. These counts could be made over a period of time and be compared with earlier periods. Ideally, because some processes are more vital to NZFS functions than others, respective processes would be weighted with those that have a greater impact on capability and readiness receiving a higher weighting.

Measuring process will be difficult, as process failures will not be frequently reported or noticed until something goes wrong. Failures will be identified most commonly in the auditing processes that are only done periodically, and for major incidents so will not provide a comprehensive picture of process failure. They also could be skewed towards specific types of processes that may be focussed on during the audit, such as life-threatening errors, while others may not receive close inspection.

This measure should not be confused with human error, which may occur with staff misunderstanding or misreading processes, or just failing to follow these processes. This failure would be under the people sub-component and related to adequate staff training.

5.4 Weightings and structure

Together the people, equipment and process sub-components measure the resources that must be maintained by the NZFS. To create a measure of capability and readiness in index form, we have allocated *default* weights to these three sub-components.

These weights are essentially judgement calls, based on our reading of NZFS activity, functions and work. While each sub-component is vital to the effective running of the NZFS, in our view people and equipment should be weighted higher than the process sub-component, as these inputs are more important in regards to the capability and readiness of the NZFS. Following this line of reasoning, we have attributed a 40-40-20 ratio between our weights.

However, we recognise that further research and discussion would be ideal. This work is needed to enable the weights to be more robustly grounded in information about the relative importance of the sub-components in the determination of capability and readiness.

Table 5.1 Weightings by input type and question

Input/Question	Weighting
Workforce	**40%**
1. Are staff adequately trained to the level to do their job?	24%
2. Is the training suitable, in terms of:	
a. Quality/effectiveness of training	0%
b. Frequency of training	0%
3. Are there sufficient staff to adequately perform NZFS tasks?	16%
Equipment	**40%**
1. Is current equipment performing adequately in terms of:	
a. Fit for purpose	12%
b. Reliability	12%
2. Does the NZFS have sufficient equipment to perform their duties?	12%
3. Is the NZFS keeping track of and incorporating technological improvements into their equipment as they become available?	4%
Process	**20%**
1. Are there policies/processes in place for every situation the NZFS comes across?	10%
2. Are the policies/processes in place effective in all situations?	10%
Total	**100%**

Within the sub-components, we have also weighted indicators and posed these as individual questions, as outlined in the previous section. An ideal measure of the capability and readiness of the NZFS would have an indicator reflecting each of the questions.

For example, in the people sub-component BERL believes it is more useful to look at levels of training as opposed to trying to gauge the quality of training. Training courses are rigorously checked to keep accreditation levels, suggesting that the quality of this training will not change over time. Frequency of training will be indirectly measured in the level of training question also, making it unnecessary. Therefore, we have assigned zero weight to two parts of question two within the people sub-component.

Practically it will be difficult to answer some of the questions in the ideal CPM. This is due to difficulties in measurement or in obtaining the relevant information.

For these reasons, the working CPM described in section 6 contains only those questions where indicators are currently measurable and obtainable.

6 An indicative stylised CPM

This section follows on from the discussions on what readiness and capability are, the roles of the NZFS, and the theoretical discussion of an index of capability and readiness. It lays out a recommended CPM based on data that is currently available. The next section of this report deals with indicators we believe would be useful additions to the current proposed CPM, or where changes in data availability or NZFS duties and equipment may require an update in the structure of the CPM.

Table 6.1 presents the suggested components and weightings for the CPM, based on data currently available, and/or confirmed to be collected in the June 2009 reporting year. Note that data values for each year are mostly dummy data, showing how the CPM works rather than real data.

Table 6.1 Suggested components and weightings of CPM including dummy data

Indicator	Weight	Annual results as at 30 June				
		2003	2004	2005	2006	2007
People	**40.0**	**40.0**	**43.4**	**39.3**	**42.0**	**41.8**
Skills maintenance: cannot field a crew - red lights	9.0	9.00	8.01	7.53	8.96	10.15
Non-fire incident training: duty-adjusted training level	8.0	8.00	7.88	7.92	7.92	7.61
Leadership level: non-qualified commander incident responses	6.0	6.00	5.67	5.34	5.88	6.13
Staff retention: weighted staff turnover rate	8.0	8.00	10.88	9.79	9.68	9.83
Crew resourcing: cannot field a crew - firefighter shortage	9.0	9.00	10.99	8.70	9.52	8.12
Equipment	**40.0**	**40.0**	**40.4**	**43.2**	**48.1**	**47.5**
Red fleet readiness: unscheduled maintenance	9.0	9.00	8.64	10.31	10.07	9.54
Red fleet capability: appliances over 25 years old	5.0	5.00	5.61	6.17	6.48	6.48
Critical equipment capability: checks failed	8.0	8.00	5.02	5.93	7.65	8.04
Standard stowage readiness: checks failed	8.0	8.00	8.85	9.29	10.26	10.19
Apparel maintenance: unchecked Level 2 gear	10.0	10.00	12.23	11.50	13.64	13.22
Process and policy	**20.0**	**20.0**	**23.7**	**25.9**	**25.4**	**24.8**
Station positioning: distance to incident	5.0	5.00	5.03	4.98	4.95	4.90
HAZMAT positioning: responses requiring 60+ minutes	2.0	2.00	2.56	2.75	2.38	2.68
Equipment check procedure: checks missed	7.0	7.00	9.83	11.52	11.02	10.11
Disptach communication: time from CommCen to fire station alert	3.0	3.00	3.05	3.24	3.59	3.67
Evacuation planning: high-risk buildings planned for	3.0	3.00	3.22	3.35	3.41	3.41
Index	**100.0**	**100.0**	**107.5**	**108.3**	**115.4**	**114.1**

The CPM consists of three sub-components – people, equipment, and process, with weights of 40, 40, and 20 as discussed in the previous section. Within each sub-component, we have used indicators that capture a particular aspect of capability and readiness. We have also tried to ensure that we do not double count by including more than one indicator that measures the same thing.

The table, based mostly on dummy data, would be interpreted by saying that the NZFS was 14.1 percent more capable and ready in 2007 than in 2003, while it had its best result in 2006. One could further say that the best improvements had been in process and policy (up

24 percent from 20.0 to 24.8), and equipment (up 19 percent from 40.0 to 47.5). Gains in the people sub-component were smaller, up 4.5 percent (from 40.0 to 41.8).

The following three sub-sections discuss what the indicators within the three sub-components are and the rationale for including them.

6.1 People

There are five suggested indicators in this sub-component. The first three indicators relate to training and leadership, one to staff retention and experience, and the last to resourcing.

The skills maintenance and crew resourcing indicators in this sub-component carry the largest weights – nine points each. This is because they represent a fundamental breakdown, where crews cannot respond.

Non-fire incident training and staff retention each have a weighting of eight. These factors do not measure the ability of the NZFS to respond, but rather the levels of training and experience they have to deal with incidents. Leadership level has a weighting of five. While having an officer-qualified firefighter on each appliance leaving the station is the goal, we assess this as being relatively lower in importance to capability and readiness than the other factors in this sub-component.

6.1.1 Skills maintenance

Skills maintenance is an essential feature of capability and readiness. The Operational Skills Maintenance System, currently being implemented by the NZFS, records the training level of individual firefighters and when they last undertook a refresher course. The system includes pre-set time periods within which refresher training must be undertaken. It uses a colour-coding system that shows an orange light when three-quarters of the time period during which refresher training must be undertaken has gone. The light turns red once the training window has closed. A firefighter cannot crew an appliance if they have a red light for any of the critical skills required to crew an appliance.

This indicator measures the instances where an appliance cannot be fielded because at least one of its crew has a red light for one or more critical skills maintenance training courses. It is measured as a rate – the number per 1,000 incidents. Anecdotal evidence suggests this figure is likely to be low, as most firefighters ensure their training is up-to-date. Nevertheless, that the NZFS is likely to do well on this indicator is no reason for exclusion.

Table 6.2 Skills maintenance indicator including dummy data

	Annual results as at 30 June				
Skills maintenance	**2003**	**2004**	**2005**	**2006**	**2007**
Nearest station could not field crew due to crew having red lights on critical skills	28	32	34	29	27
Incidents	80,675	82,104	81,987	83,168	87,748
Rate per 1,000 incidents	0.35	0.39	0.41	0.35	0.31
CPM indicator value	**9.00**	**8.01**	**7.53**	**8.96**	**10.15**

The lower the rate per 1,000 incidents, the better the capability and readiness of the NZFS, as this suggests that firefighters are maintaining their skills.

6.1.2 Non-fire incident training

Non-fire incident training measures the extent to which NZFS personnel are appropriately trained for the non-fire incidents they respond to in any given year. For example, in the 2007 calendar year, 46 percent of all non-false alarm call-outs were for non-fire incidents. This includes 21 percent for rescue or medical incidents, 13 percent for hazardous materials, 9 percent for special services, and 4 percent for natural disasters.

Using these figures to interpret how well the training of firefighters fits their duties is not easy. For example, there are no standardised courses that fit special services incidents, which is a catch-all phrase for incidents not included elsewhere. Hazardous materials incidents, while accounting for a large proportion of incidents, are typically small-scale, and are handled with skills learned in basic firefighter training, rather than in advanced hazardous materials training. This advanced training is undertaken by only a small number of personnel. Nevertheless, incident response data captures any hazardous materials incident although the vast majority of cases are handled by non-specialist crews.

At present, this indicator only measures the extent to which appropriate proportions of firefighters are trained to deal with rescue and medical incidents, and natural disasters, through monitoring road crash rescue, and urban search and rescue training respectively.

Table 6.3 Non-fire incident training indicator including dummy data

Non-fire incident training	Annual results as at 30 June 2003	2004	2005	2006	2007
Proportion of all non-false alarm incidents					
Rescue / medical incidents	18.6	19.1	19.6	19.8	20.6
Natural disasters	3.1	2.8	3.2	3.8	3.5
Proportion of firefighters with training in					
Road crash rescue course	30.9	31.5	33.5	34.9	34.3
Urban search and rescue (USAR) category one*	13.3	12.4	12.5	12.7	12.4
Rate of training to incidents					
Road crash rescue course	1.66	1.65	1.71	1.76	1.67
Urban search and rescue (USAR) category one*	4.28	4.44	3.89	3.33	3.53
Weighted average of non-fire incident C&R	2.04	2.01	2.01	2.02	1.94
CPM indicator value	**8.00**	**7.88**	**7.92**	**7.92**	**7.61**

** Volunteers to be trained to USAR Cat 1 awareness level, and career firefighters to USAR Cat 1 response level.*

The higher the weighted average of non-fire incident capability and readiness, the better prepared the NZFS is to tackle a range of non-fire incidents.

6.1.3 Leadership level

The leadership indicator measures the rate of incidents responded to by firefighters who do not have an officer-qualification (i.e. a senior firefighter or someone of a lower rank who has not completed officer qualification training) in command of an appliance. This indicator highlights instances where a standardised level of leadership training is not present in an incident response.

Table 6.4 Leadership level indicator including dummy data

Leadership level	Annual results as at 30 June 2003	2004	2005	2006	2007
Incidents in which non-officer qualified firefighter takes charge of appliance	78	84	89	82	83
Incidents	80,675	82,104	81,987	83,168	87,748
Rate per 1,000 incidents	0.97	1.02	1.09	0.99	0.95
CPM indicator value	**6.00**	**5.67**	**5.34**	**5.88**	**6.13**

The rate of incidents in which an appliance is fielded without officer-qualified personnel per 1,000 incidents is used. The lower the rate per 1,000 incidents suggests a better level of leadership resourcing and a lower proportion of non-standard responses.

6.1.4 Staff retention

Staff retention measures the average turnover rate for firefighters, communication centre, and managerial and support staff. It measures the extent to which the NZFS is able to retain staff and their skills and qualifications.

Table 6.5 Staff retention indicator including dummy data

	Annual results as at 30 June				
Staff retention	**2003**	**2004**	**2005**	**2006**	**2007**
Firefighters	2.63	2.22	2.60	2.18	1.19
Communication centre staff	16.40	12.09	4.05	6.70	7.98
Managerial and support staff	9.40	10.99	9.55	11.80	7.57
Weighted average turnover rate (%pa)	4.84	3.56	3.96	4.00	3.94
CPM indicator value	**8.00**	**10.88**	**9.79**	**9.68**	**9.83**

A lower turnover rate is better, as it suggests an improvement in NZFS capability and readiness due to retention of skills and experience.

6.1.5 Crew resourcing

Crew resourcing measures the extent to which crews are in place in the right areas to respond to incidents. The indicator looks at the proportion of incidents for which the NZFS was unable to field a crew from the nearest station because there were not sufficient crew members available. Policy stipulates that an appliance may not be fielded if either of the following occurs:

- No qualified driver is available.
- Fewer than four firefighters are available.

The indicator is measured as the instances in which a crew could not be fielded as a rate per 1,000 call-outs.

Table 6.6 Crew resourcing indicator including dummy data

	Annual results as at 30 June				
Crew resourcing	**2003**	**2004**	**2005**	**2006**	**2007**
Nearest station could not field crew due to lack of driver or sufficient crew numbers	78	65	82	76	94
Incidents	80,675	82,104	81,987	83,168	87,748
Crew not fielded per 1,000 call-outs	0.97	0.79	1.00	0.91	1.07
CPM indicator value	**9.00**	**10.99**	**8.70**	**9.52**	**8.12**

A lower rate of call-outs in which a fire station cannot field a crew suggests a higher level of capability and readiness, as the nearest fire station was able to respond on a higher proportion of occasions.

6.2 Equipment

There are five suggested indicators in this sub-component. The first two indicators relate to appliance capability and readiness, the next two to standard stowage and critical (shared) equipment, and one to apparel maintenance.

Our focus in terms of appliances is on the red fleet, which consists of pumps and rescue appliances, aerial appliances, and hazardous materials/command (HAZMAT/command) units. These are the vehicles primarily involved in the response side of NZFS work and are an important measure of capability and readiness.

Red fleet readiness and capability are measured as two separate indicators on the CPM, with a total weight of 14. Capability, measured as the number of appliances over 25 years old is given a lower weighting than readiness (five compared with nine). In most cases an older appliance is still able to do the job as well as a newer one. It may not have the level of automation or comfort but it can generally respond as quickly and result in a similar outcome. Readiness with a weight of nine measures the rate of unscheduled appliance maintenance.

The two measures of equipment have a relatively high weight of eight, as these measures indicate the extent to which the NZFS equipment is functioning correctly (capability) and is on the appliance ready to be used at an incident (readiness).

Apparel maintenance, as the only indicator of the capability and readiness of personal equipment within the NZFS, has a weight of 10.

6.2.1 Red fleet readiness

Red fleet readiness measures the number of times an appliance in the red fleet is out of service due to unscheduled maintenance. These are effectively incidences of breakdowns, when the vehicle cannot respond as a result of a mechanical failure. The indicator is measured as the rate of instances of unscheduled maintenance per 100 vehicles.

Table 6.7 Red fleet readiness indicator including dummy data

	Annual results as at 30 June				
Red fleet readiness	**2003**	**2004**	**2005**	**2006**	**2007**
Unscheduled maintenance incidents	78	81	68	70	75
Total vehicles in red fleet	921	918	920	925	939
Rate per 100 vehicles	8.47	8.82	7.39	7.57	7.99
CPM indicator value	**9.00**	**8.64**	**10.31**	**10.07**	**9.54**

A lower rate means a higher level of readiness, as it suggests vehicles are in better condition, do not need to undergo unscheduled maintenance, and are capable of functioning when they are called on.

6.2.2 Red fleet capability

For red fleet capability, we have included an indicator that measures the proportion of the red fleet older than the ideal life-span of a red fleet vehicle – 25 years. Some would argue that the majority of differences between an appliance built in 1980 and one built today are

cosmetic or comfort-related. Taking into account this perspective, a relatively low weighting has been applied to the indicator. Nevertheless, this measure will also capture changes in technology over time that could positively impact on the capability of the NZFS.

This indicator is measured as the number of red fleet vehicles aged over 25 years per 100 vehicles.

Table 6.8 Red fleet capability indicator including dummy data

	Annual results as at 30 June				
Red fleet capability	**2003**	**2004**	**2005**	**2006**	**2007**
Vehicles over 25 years old	89	79	72	69	70
Total vehicles in red fleet	921	918	920	925	939
Rate per 100 vehicles	9.66	8.61	7.83	7.46	7.45
CPM indicator value	**5.00**	**5.61**	**6.17**	**6.48**	**6.48**

A lower rate suggests a higher level of capability, as this means there was a lower proportion of vehicles over 25 years old. It also means there is less chance of the vehicle breaking down, that the vehicle will be reliable and that there will be less chance of faults.

6.2.3 Critical equipment capability

This indicator measures the proportion of routine maintenance checks on standardised equipment in which equipment fails. The NZFS Asset Management System (AMS), which monitors each piece of equipment critical to NZFS functions, is linked to the Station Management System (SMS) at each fire station. The AMS automatically notifies the SMS of any critical equipment checks that need to be carried out, and logs if and when this maintenance check is carried out.

It is thus possible to record the proportion of all critical equipment maintenance checks that fail. The indicator thus provides a measure of whether or not equipment is in good working order, or capable of doing the job required.

Table 6.9 Critical equipment capability indicator including dummy data

	Annual results as at 30 June				
Critical equipment capability	**2003**	**2004**	**2005**	**2006**	**2007**
Crictical equipment failed checked	138	219	186	145	140
Critical equipment checks required this year	47,892	47,736	47,840	48,100	48,828
Rate per 1,000 checks	2.88	4.59	3.89	3.01	2.87
CPM indicator value	**8.00**	**5.02**	**5.93**	**7.65**	**8.04**

The lower the rate of failed checks per 1,000 checks, the better the NZFS is maintaining its equipment, and therefore the better its capability and readiness.

6.2.4 Standard stowage readiness

This indicator measures the proportion of routine stowed storage checks that fail. Stowed storage checks ensure all essential items are accounted for on an appliance. These checks are mandated to be carried out twice daily on career firefighter-crewed appliances, and once a week on volunteer-crewed appliances. This information is recorded, allowing a check of the number of standard stowage stocktakes that failed.

Table 6.10 Standard stowage maintenance indicator including dummy data

	Annual results as at 30 June				
Standard stowage readiness	**2003**	**2004**	**2005**	**2006**	**2007**
Standard stowage storage checks failed	756	681	650	592	605
Standard stowage checks required this year	172,780	172,217	172,592	173,530	176,156
Rate per 1,000 checks	4.38	3.95	3.77	3.41	3.43
CPM indicator value	**8.00**	**8.85**	**9.29**	**10.26**	**10.19**

The lower the rate for this indicator, the higher the level of readiness in terms of ensuring essential equipment is in place.

6.2.5 Apparel maintenance

This indicator measures the proportion of Level 2 (turnout) gear that, on being submitted for a routine (mandated) check, is found to be unsuitable for use. The NZFS has introduced a total care programme for Level 2 gear. In this programme each item of clothing is barcoded. This allows the NZFS to track each item of clothing, and to notify firefighters when clothing is due for a check. However, if Level 2 gear is damaged before the date it is due for a routine check, it should be checked immediately.

This indicator therefore measures the extent to which damaged gear is determined to not be at the station level. This suggests a reduction in the capability and readiness of the NZFS in that it increases the possibility of injury to staff by the apparel not being in a safe and usable condition.

Table 6.11 Apparel maintenance indicator including dummy data

	Annual results as at 30 June				
Apparel maintenance	**2003**	**2004**	**2005**	**2006**	**2007**
Apparel maintenance checks failed	60	49	53	45	47
Apparel maintenance checks required this year	16,013	15,995	16,260	16,375	16,578
Rate per 1,000 checks	3.75	3.06	3.26	2.75	2.84
CPM indicator value	**10.00**	**12.23**	**11.50**	**13.64**	**13.22**

The lower the rate for this indicator, the better the level of maintenance of Level 2 gear, and the greater the level of capability and readiness.

6.3 Process and policy

The indicators in this sub-component of the CPM are related to policies and processes that are in place to ensure the NZFS maintains capability and readiness. Two relate to resourcing – station positioning and HAZMAT/command vehicle positioning, one relates to equipment capability and readiness policy, one relates to communications protocols, and one to evacuation planning.

The process and policy sub-component carries a weight of 20. Within this sub-component, the equipment check indicator carries the most weight, at seven points. This is because it consists of three sub-indicators which together measure how well the NZFS follows policy on checking that equipment is ready and capable to do the job required.

Station positioning carries a weight of five points. This is because positioning stations appropriately ensures a quick response and positive outcomes from fires and other incidents.

Dispatch communication has a weight of three, and measures how rapidly a call for help is transferred to the relevant NZFS personnel. Similarly, evacuation planning carries a weight of three. HAZMAT positioning has a relatively low weight of two, as HAZMAT vehicles are dispatched to a small proportion of incidents.

6.3.1 Station positioning

This indicator measures the average distance travelled by first responder vehicles to reach incidents. By comparing changes across years, the NZFS will be able to see if resourcing needs have changed, and if new stations need to be built, or if areas are well-served by fire stations.

Table 6.12 Station positioning indicator including dummy data

	Annual results as at 30 June				
Station positioning	**2003**	**2004**	**2005**	**2006**	**2007**
Average distance travelled by first responder	2.77	2.75	2.78	2.80	2.82
CPM indicator value	**5.00**	**5.03**	**4.98**	**4.95**	**4.90**

A lower average distance suggests that station resourcing is improving, as the average distance travelled to reach an incident has decreased. This indicates a better level of capability and readiness, as the NZFS are able to quickly respond to incidents.

6.3.2 HAZMAT positioning

The NZFS is rolling out 17 new, standardised HAZMAT/command units, which will be deployed by June 2010. The goal of the NZFS is to be able to deploy a unit anywhere in

New Zealand within 60 minutes. The positioning of the unit is therefore crucial. This indicator measures the number of HAZMAT unit call-outs where a unit was unable to reach the incident within 60 minutes.

Although the new HAZMAT units will not all be in place until 2010, this indicator can still be used to measure the current capability and readiness of the NZFS to deal with hazardous materials incidents requiring specialist units and crews.

Table 6.13 HAZMAT positioning indicator including dummy data

	Annual results as at 30 June				
HAZMAT positioning	**2003**	**2004**	**2005**	**2006**	**2007**
Incidents not reached within 60 minutes	27	24	22	26	24
HAZMAT call-outs	597	680	670	685	710
Rate per 100 incidents	4.52	3.53	3.28	3.80	3.38
CPM indicator value	**2.00**	**2.56**	**2.75**	**2.38**	**2.68**

A lower rate for this indicator means the number of instances in which HAZMAT units have not been able to respond in an appropriate amount of time has fallen, suggesting better capability and readiness.

6.3.3 Equipment check procedure

This indicator measures the proportion of mandated checks of critical equipment, standard stowage, and Level 2 gear that are missed. In other words, it measures the extent to which NZFS policy on checking equipment is followed. Not following policies puts the NZFS at risk of not being able to perform when necessary, as equipment may be found to be damaged or not present on the appliance.

This indicator is linked to three in the equipment sub-component that deal with critical equipment, standard stowage, and Level 2 gear. However, where the equipment indicators looked at the rate of equipment checks that failed, the policy measure looks at the rate of equipment checks missed. The indicator is calculated as the average of the rate of checks missed per 1,000 checks across the three sub-indicators.

As explained above, the AMS, which monitors each piece of equipment critical to NZFS functions, is linked to the SMS, in place at each of the NZFS stations. The AMS automatically notifies the SMS of any critical equipment checks that need to be carried out, and logs if and when this maintenance check is carried out. It records how many critical equipment checks carried out by appropriately-certified staff are not completed within the required timeframe, or are missed.

Similarly, stowed storage checks are mandated to be carried out twice daily on career firefighter-crewed appliances, and once a week on volunteer-crewed appliances. If standard stowage checks are regularly missed, it suggests that policy is not being followed.

Each piece of Level 2 gear is barcoded and is to be checked a certain number of times a year (at least once is the current standard). If it does not undergo at least one routine check per year, the policies the NZFS has in place to protect personnel are being compromised. This suggests a lower standard of capability and readiness to perform when needed and puts firefighters at risk.

Table 6.14 Equipment check procedure including dummy data

	Annual results as at 30 June				
Equipment check procedure	**2003**	**2004**	**2005**	**2006**	**2007**
Critical equipment					
Checks missed	919	588	491	528	615
Checks required this year	47,892	47,736	47,840	48,100	48,828
Standard stowage					
Checks missed	294	310	300	278	270
Checks required this year	172,780	172,217	172,592	173,530	176,156
Level 2 gear					
Checks missed	118	96	84	88	90
Checks required this year	16,013	15,995	16,260	16,375	16,578
Weighted average of checks / 1,000 missed	9.42	6.71	5.72	5.98	6.52
CPM indicator value	**7.00**	**9.83**	**11.52**	**11.02**	**10.11**

A lower rate for this indicator means that fewer checks are missed, and the NZFS is better following equipment check procedures. This suggests a higher level of capability and readiness.

6.3.4 Dispatch communication

This indicator measures the capability of the communication centres to ensure that the appropriate station is alerted in a timely manner. This indicator incorporates people (communication centres staff training) and equipment (computer software and hardware) aspects. However, it is included in the process and policy component of the CPM because it is reliant on policy and process to ensure that the nearest station is notified, that the right appliance is deployed, and that this occurs within an appropriate timeframe.

The NZFS currently has a target transfer time of two minutes. However, calls are timed from the moment they are received to the time an appliance becomes available and can be dispatched. Occasionally, when there is a natural disaster, for instance, dispatch times may be much longer as the communication centre waits for an appliance to become available before it calls through the next incident. Years in which there are a large number of natural disasters will tend to have unusually high average dispatch times. To eliminate this

influence, this indicator measures the average dispatch time for the 90th percentile of calls through the communication centres.

Table 6.15 Dispatch communication indicator including dummy data

	Annual results as at 30 June				
Dispatch communication	**2003**	**2004**	**2005**	**2006**	**2007**
Average time from CommCen to station alert (seconds)	176	173	163	147	144
CPM indicator value	**3.00**	**3.05**	**3.24**	**3.59**	**3.67**

A shorter average time indicates a better level of capability and readiness, as this means policies and processes are in place to ensure the nearest station is notified as quickly as possible.

6.3.5 Evacuation planning

This indicator measures the proportion of identified high-risk buildings for which the NZFS has in place an evacuation and risk management plan. The reason for including this indicator is that having a larger proportion of evacuation schemes in place is likely to affect the ability of the NZFS to respond to an incident at a high-risk property. As firefighters will have visited the property and have knowledge of it, their capability and readiness to deal with an emergency incident at that site will be increased.

Table 6.16 Evacuation planning indicator including dummy data

	Annual results as at 30 June				
Evacuation planning	**2003**	**2004**	**2005**	**2006**	**2007**
Evacuation plans in place	1,763	1,901	2,006	2,065	2,100
High-risk buildings identified	7,755	7,802	7,891	7,985	8,126
Rate per 100 high-risk buildings	22.73	24.37	25.42	25.86	25.84
CPM indicator value	**3.00**	**3.22**	**3.35**	**3.41**	**3.41**

The higher the rate of high-risk properties for which current evacuation plans are in place, the more ready the NZFS is to deal with an emergency at that property.

6.4 Summary

The CPM presented in this section provides a way of combining indicators of capability and readiness across the three areas of people, equipment and policy, into one index that allows comparison across years. The CPM has been constructed in such a way that any year can be chosen as a base year without changing the meaning of the index. Weights of particular indicators can also be changed if the NZFS believes certain indicators are under- or over-represented.

7 Recommendations

This section presents recommendations for improvement to the CPM. The recommendations focus on two aspects – determining the weights and data availability.

7.1 Determining the weights

Central to a CPM is the weights attached to its constituent parts. Ideally, these weights should represent the relative importance of each part to the variable or outcome of interest. In the case of this study, we need to assess just how important each of the sub-components (and thereafter each of the individual indicators) are in determining the capability and readiness of the NZFS.

Unfortunately, little guidance for this question can be gleaned from the literature. As noted in our report, much of the literature focuses on output-based measures and not the more appropriate input-based measures developed here.

Consequently, determining weights for the New Zealand CPM needs to incorporate the expertise and knowledge of NZFS personnel. Nevertheless, our framework provides a reference point from which the weighting regimen can be established. For example, rather than ask:

- How important is indicator A in influencing the capability and readiness of the NZFS?

NZFS personnel should be tested with the question

- Is indicator A of equal/more/less/ importance than indicator B in influencing the capability and readiness of the NZFS?

Numerous combinations of these questions need to be repeated across appropriate personnel who have sufficient knowledge of NZFS activities and procedures. Their respective responses can be collated to provide an overall weighting pattern. Alternatively, these questions can be posed within a workshop environment consisting of key NZFS personnel to enable an 'agreed' weighting system to be devised.

Either way, framing the questions as above reinforces the idea that weights reflect *relative* importance, rather than importance per se.

7.2 Other data for inclusion

There are a variety of data sources that are coming on-stream at the NZFS in the near future, or have recently been instituted. In addition, there are pieces of information we believe would be of use to the NZFS that may not be currently collected.

7.2.1 Incorporate NZFS independent audit programme

By far the most comprehensive measure of capability, readiness and broader performance at a station level is in the process of being developed. The NZFS intends to develop an extensive independent audit programme, complete with a standards manual and policy to ensure regular checks at the station level.

We recommend that, on completion of the standards manual, the indicators included in the equipment, and process and policy sub-components of the CPM be re-examined to determine if more suitable indicators are available.

7.2.2 Identify indicators of training for other non-fire emergencies

The suggested CPM presented in this report is limited in the extent to which it evaluates how well the NZFS is capable and ready to deal with non-fire incidents. The focus of the suggested CPM is only on road accidents and natural disasters. It considers how well the proportions of firefighters trained in medical/rescue, and urban search and rescue align with the proportions of call-outs related to road accidents and natural disasters respectively.

However, there are other areas of work undertaken by the NZFS that may not be covered by these particular training courses. For example, 13 percent of all non-false-alarm call-outs in 2007 were for hazardous materials. Only a small portion of these call-outs are likely to be serious enough to be attended by HAZMAT units, but the question remains as to whether sufficient hazardous materials training is provided to firefighters considering the proportion of incidents of this type. Alternatively, the NZFS may feel that the typical risk, in terms of lives endangered or lost, or damage done, may mean additional hazardous materials training is not a good use of resources.

We therefore recommend the following:

- Disaggregate further:
    - * the hazardous materials incident data to indicate which were serious enough for HAZMAT units to respond (see also below)

    * further disaggregation of the special services (9.1 percent of all non-false-alarm call-outs in 2007) and the rescue/medical (21 percent of all non-false-alarm call-outs in 2007) incident types to allow the NZFS to match up training needs with incident types.

- Identify training courses that most closely match with other incident types the NZFS attends. This will allow inclusion of further types of training in the non-fire incident training indicator in the CPM.

7.2.3 Incorporate training and incident type changes and improvements

As technology, best practice, or incident types attended change, it will be important to regularly update the match between training courses and incident types to ensure the non-fire incident training indicator of the CPM most accurately captures the relationship between various types of training and incident types.

For example, there may be types of incidents that account for only a small portion of NZFS incidents today that become increasingly important over time. At some stage, the CPM should be updated to include the extent to which NZFS training matches the rising importance of that type of incident within the role of the NZFS.

7.2.4 Disaggregate hazardous materials incident response data

This recommendation was already alluded to above, but is sufficiently important to warrant including here again.

The current number of hazardous materials incidents per year is large (7,222 in 2007). However, only a small proportion of these incidents require the attendance of the HAZMAT units. Disaggregating hazardous materials incidents into those that require HAZMAT unit attendance and those that do not, will give a better idea of how well the level of hazardous materials training in the NZFS matches the proportion of incidents for which such training is required.

This will allow more accurate interpretation of whether prevalence of advanced hazardous materials training within the NZFS is commensurate with the proportion of call-outs to incidents where this level of training is needed.

8 Appendix

This section briefly notes, for the record, discussions during the development of the CPM concerning the use of output measures; as well as information on the interpretation of index values.

8.1 Output measures as proxies for capability and readiness

There is some justification for using an output measure as a proxy for capability and readiness. For example, when measuring the capability of firefighters, instead of measuring their training levels or experience, the number of preventable injuries and deaths that occur per incident could be measured. If the number decreased, this could imply that capability and readiness had increased.

Initially, BERL believed this would be an effective way of measuring the duties of the NZFS. Output based performance measures of the NZFS are easy to obtain, due to a comprehensive online incident database and performance targets published in the public domain. However, using this method could result in complications that reduce the usefulness of a CPM.

One of the purposes of the CPM is for analysis. Indicator movements would be examined and if there was a negative trend then some form of corrective action would be taken. The problem with using output measures is that they can be difficult to analyse. Returning to the number of injuries per fire example, how does the NZFS determine why there has been a large increase in the number of injuries per fire and put policy in place to improve these conditions? There are a number of factors that could impact on this measure: firefighter training, equipment quality, as well as environmental factors. This makes it difficult to determine cause and effect and take corrective action.

In contrast, looking at capability and readiness from an input based perspective should maximise the usefulness of the CPM. Input indicators typically describe one specific aspect of the NZFS operation, such as workforce training or equipment reliability. Therefore it is easier to find underlying causes of change in these input-based indicators, making problems easier to identify and resolve.

In addition, using a combination of input and output measures in a CPM can cause double counting to occur. Double counting exaggerates the importance of an input indicator within the CPM by inadvertently measuring it again as an output indicator.

Output indicators measure the results of a number of different inputs (such as firefighters or equipment) coming together to produce an output such as putting out a fire. Suppose a CPM includes an output indicator, such as number of preventable injuries per fire, and an input indicator, such as the average training level of the workforce. In measuring the output you are implicitly measuring all the inputs that were used in the process of producing that output. Hence, staff training is measured explicitly in the input measure and implicitly in the output measure. This means double counting occurs, exaggerating the importance of a single input factor, by counting (and thereby weighting) it twice.

Given these potential complications, there is sufficient argument to avoid using output measures as proxies of capability and readiness in the CPM, and focus on an input-based approach.

8.2 Interpretation

The CPM is expressed in the form of an index. This section outlines how indices work and how they should be interpreted.

An index is a useful tool as it can be used to measure change over time for a range of different indicators, and can compile these measurements into a single result.

In the NZFS CPM, indicators are combined using weights. These weights and the relevant indicator values are combined and expressed as an index number. This index number can be compared between years.

The formula for calculating an index *(I)* is as follows:

$$I = \frac{\sum(v_1 * w)}{\sum(v_0 * w)} * 100$$

where v_1 is the current value of the indicator;

v_0 is the value of the indicator at the base year; and

w is the weight of that indicator in the index;

with the index expressed as 100 in the base year.

Interpreting index numbers is relatively straightforward. The key thing to note is that the index only measures a change or percentage change; the number in itself is meaningless. The following table presents an example index. In this table it can be seen that

performance, as reflected in the weighted values of the indicators, has increased by 5 percent from year 0 to year 1, and fallen by 1.9 percent between year 1 and year 2.

Table 8.1 Index example

Period	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Index value	100	105	103	107	110	115
% change from previous year		5.00	-1.90	3.88	2.80	4.55

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