

Learning from the Christchurch Earthquake



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While many will recall the earthquakes that struck Christchurch, New Zealand in September 2010 and February 2011, perhaps few will appreciate that, as well as dealing with the immediate needs of the community, the fire service was itself a 'victim' of the earthquake. In addition to the loss of life in Christchurch itself, the earthquake caused widespread and significant damage to property and infrastructure, including structural damage to two fire stations, giving rise to the construction of temporary stations and facilities to support operations during the recovery phase.

A combination of significant property and population relocation, combined with the requirement to consider its own re-building needs, led the Fire Service Commission to identify in its 2010/11 Annual Report that: "Christchurch stations may need to be repositioned to service a redesigned city" and consequently commissioned a study to examine locations for optimal fire station deployment.

The objectives of the pilot study were to identify, by the use of an evidence-based facility location planner, optimal locations for fire stations in Christchurch while also considering the future community risk reduction and resilience role of the fire and rescue service. The study commenced with a diagnosis of existing performance and workload using data provided by the Service.

Strategic Context

It was important to establish the strategic and operational context for the study and the objectives of the Service from which future deployment decisions could be made. A number of high-level reference documents that pre- and post-date the February 2011 earthquake were reviewed including:

- The New Zealand Fire Service Commission (NZFSC) Strategic Plan.
- The Canterbury Earthquake Recovery Authority (CERA) Strategy.
- The Christchurch City Council Draft Central City Recovery Plan.
- The National Crisis Disaster and Emergency/Management Strategy.

The recurring theme within these strategic outcomes and objectives is the development of safer and more resilient communities, which in turn provided a focus for the future direction and deployment of fire service resources in Christchurch.

Multi-agency Collaboration

It is important to recognise the value of collaborative and focused community engagement; reducing organisational resources and inputs while maximising outcomes. Fire stations, as fixed standalone entities, regardless of whether or not they contain 'community' facilities could be counter-productive in terms of securing positive engagement with the public and working with partner organisations in the community.

Key to future success generally and for the Service

in particular comes from finding the means to harness the collective potential of all relevant agencies and groups and integrating 'resilience' into future, cross-cutting risk reduction programmes, utilising the Service's position of trust and respect in the community to influence behaviours. Such an approach could lead to an operating concept for the Service that, for ease of reference, could be described as a 'garage and shop' approach – locating functional resources and support facilities in optimum locations based on response standards and incident analysis, while creating a more mobile and public-facing workforce that operates in established community locations alongside delivery partners.

Incident Response Analysis and Optimisation

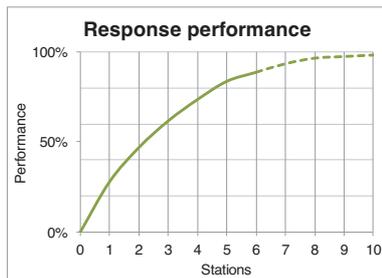
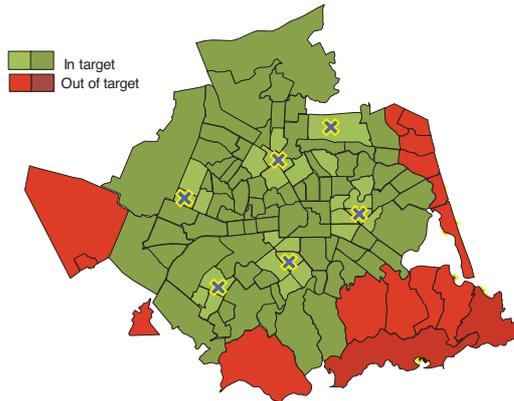
For incident response, the NZFSC has a Service Delivery Guideline (SDG) that distinguishes between appliances crewed by career and volunteer fire-fighters. For volunteers there is an additional three minutes added to enable personnel to respond to the station. The guideline includes a 'success or failure' factor based on meeting the response times on 90 percent of occasions (see table next page).

The New Zealand Fire Service Commission recognises the fact that there are a number of factors that contribute to the likelihood of survival in a structure fire and that, due to the inexact nature of fire development, the attendance of the fire service is not a guarantee of survival. It highlights in its Statement of Intent (2008/2011) that: "...the time from when a fire starts to when it becomes unsurvivable has reduced, in some cases, to less than five minutes. This means response is no longer as effective in reducing the consequences of fire. The change in the speed of fire growth highlights the need for an increasing focus on fire safety education".

Analysis

Incident analysis and resource optimisation tools provide the opportunity to identify how, where and when operational response standards can be achieved while, at the same time, securing the necessary resources to commit to fire prevention and community resilience work. For the purpose of the Christchurch location review, incident data was used that was provided by the Service for the Christchurch metropolitan area between 1 April 2007 and 31 March 2012.

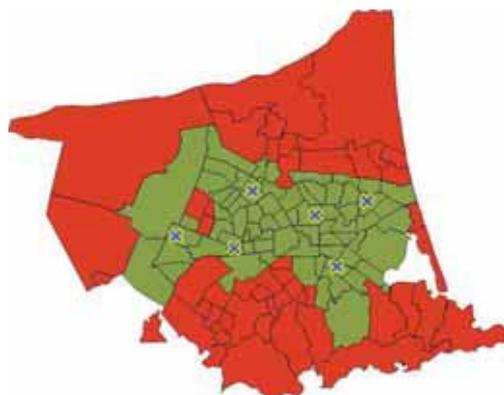
New Zealand Fire Service appliance response guidelines



Historical demand analysis was combined with future demand predictions (based on planned building development) and existing and planned road networks. This information was used in Process Evolution's Facility Location Planner to identify the optimum station locations in order to maximise the number of incidents reached within the target times. Additional scenarios were also evaluated to assess the impact on performance if some of the existing stations were to be retained in the future. Analysis of historical demand is shown graphically in a heat-map divided into Lower Super Output Areas (SOAs), taking account of predicted demand based on future development and the red-zoning of certain areas considered highly susceptible to future earthquakes. A number of scenarios can be evaluated with different demand profiles and response targets.

The models developed provided NZFS with an initial insight into optimum locations, but also highlighted how the optimum locations would change under different strategies relating to a risk-based approach to response. In addition, applying Process Evolution's Fire Incident Response Simulator (FIRS) would provide a full understanding of how performance and resilience can be maintained while attending simultaneous incidents with a wider mix of vehicle types.

The map shown here indicates the optimum station locations if NZFS were to have six stations in

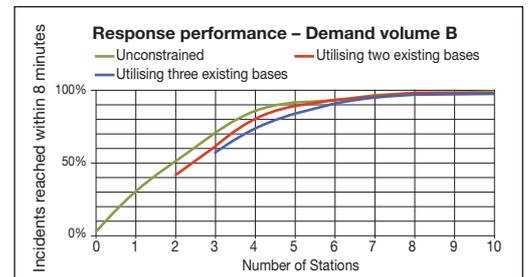


the Christchurch Metropolitan area utilising current target response guidelines. Note that the map is for indication purposes only and does not represent the potential location of future stations. The performance graph indicates the percentage of incidents attended within target compared with the number of optimally placed stations.

If response target guidelines were to change or a risk-based strategy adopted then the optimum locations could change as shown in the following maps.



A six-station, seven-minute response standard shown on the above map places the stations closer together to maximise the number of incidents that may be reached from the locations. The next map shows an eight-minute target, spreading the stations further apart and covering a greater geographical area.



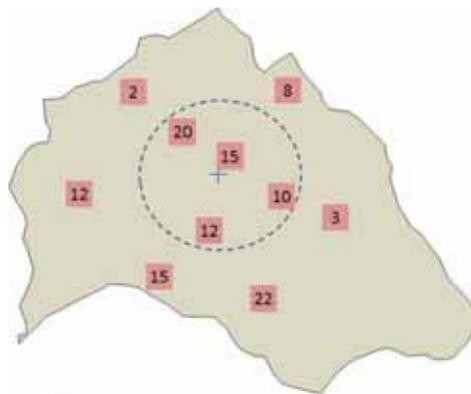
Where the modelling indicated optimum locations close to existing stations the impact on overall performance of utilising these stations was evaluated. The following graph shows a comparison of performance if two additional (optimum) stations had been located there was little difference in performance.

The map diagram on the next page shows how the optimum position of a station or deployment position could change based on 'life-risk' incidents. The map on the left has total incident volume and the one on the right reflects the 'life-risk' demand. This is just an example but highlights how optimum locations may move around the geography based on risk.

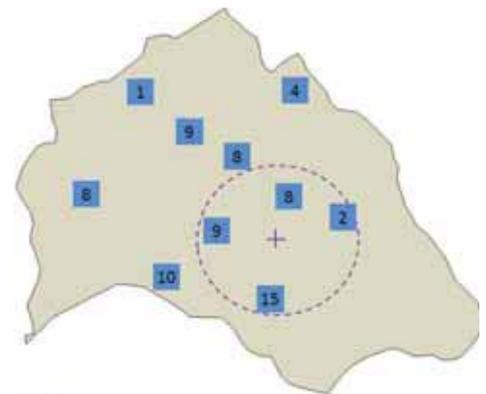
Opportunities for Consideration

As the study showed, incident analysis and modelling could be used to support optimum station location decisions based on historical incidents and current performance guidelines. This however is only one part of the risk reduction management approach relative to the future of the Service in Christchurch; the other elements for consideration being:

- An enhanced role of the Service in community resilience and public safety.
- The static and generally inflexible nature of traditional fire stations.



■ Number of incidents in area
--- 8 minute travel zone
+ Optimum position



■ Number of Life-risk incidents in area
--- 8 minute travel zone
+ Optimum position

- The expected 'life' of a fire station (20 to 30 year commitment) within a changing community risk profile.
- Appliances and crews rather than stations being key to operational response intervention.
- The opportunity to locate resources in high or transient risk areas at times of peak demand (increased mobility).
- Determining the functional requirements of a station (supporting role-based activity).
- Improving opportunities to engage with communities.
- Improving opportunities to collaborate with other emergency services and resilience professionals including co-location and cross-discipline service delivery.
- Contributing to the regeneration and sustainability of the Christchurch area.
- Securing a greener footprint and reducing the environmental impact of service provision.
- The potential to secure improved safety and resilience in the City's major rebuilding programme thereby reducing the potential requirement for operational intervention and improving sustainability.
- Balancing operational intervention with prevention and education activities.
- Securing a new risk reduction relationship with the business community.
- Alternative appliance deployment models to improve working capacity.

Community Resilience & Public Safety Roles

The rebuilding and regeneration of Christchurch provides a unique opportunity to link strategic objectives, review joint working opportunities and enter into appropriate professional relationships to secure them. How and where such opportunities might be delivered could also have an impact on the future location of fire service resources in the Christchurch area based on securing the most effective means of engaging with and supporting 'at risk' communities. The fire service is well placed to take a lead role in this work given the current level of public trust and confidence ratings of 98% (Annual Report 2011).

A potential approach to multi-agency working to secure the above, based on established risk reduction models is as follows:

- 1 Establish the collective organisational context – vision, mission and objectives.
- 2 Identify and cross-reference existing and potential hazards in the community utilising data from a range of sources/agencies.
- 3 Assess and evaluate the risk associated with those hazards and the sections of the community at greatest risk.

- 4 Evaluate the effectiveness of existing risk reduction programmes and response arrangements.
- 5 Identify addressable multi-dimensional aspects of risk and opportunities for improvement: develop protocols, policies and standards for multi-agency service/programme delivery.
- 6 Identify the resource needs and deployment arrangements including mobile and location based services.
- 7 Implement, monitor and review performance.

Allied with the potential advantages to be gained by the integration of fire service risk reduction objectives with those of partner agencies is the opportunity to work collectively to achieve the outcomes contained within the National CDEM Strategy: "...individual and community responsibility and self-reliance" and "...the responsibility of people and communities to provide for their own well-being", which is in keeping with the Commission's Vision and Mission of "...working with communities to protect what they value" (Strategic Plan 2005-2010).

The drive for improved risk reduction outcomes across sectors and a reduction in incident demand/fire service deployment combine to provide an opportunity for delivery partners to reduce demand and create an environment within which communities plan, prepare and where possible deal with a range of incidents themselves without recourse to emergency responders.

This approach models the integrated 'all hazards' approach envisaged by the National CDEM body and provides the possibility for all responding agencies to work together for mutual and community benefit. The Service was invited to consider the means to enable other agencies in partnership with the Service to deliver the wider community safety and resilience objectives based on the principle of transferring responsibility to the community and away from the State.

Summary & Conclusions

In summary, the study showed that:

- It is possible to increase coverage, for example, incidents reached within 8 minutes with six bases.
- Locations are sensitive to response focus, for example, life risk versus other incidents.
- There is a degree of variation in mobilisation times between stations, by time of day and incident types.
- There is an opportunity to more closely integrate strategic objectives and service delivery in relation to safety and resilience outcomes, in keeping with the Government's Better Public Services agenda.
- Given the prevention objectives of the service, there is potential to review the role of the fire station as a base for public engagement. **APF**

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For further information, go to www.processevolution.co.uk or www.fireandlifesafety.co.uk