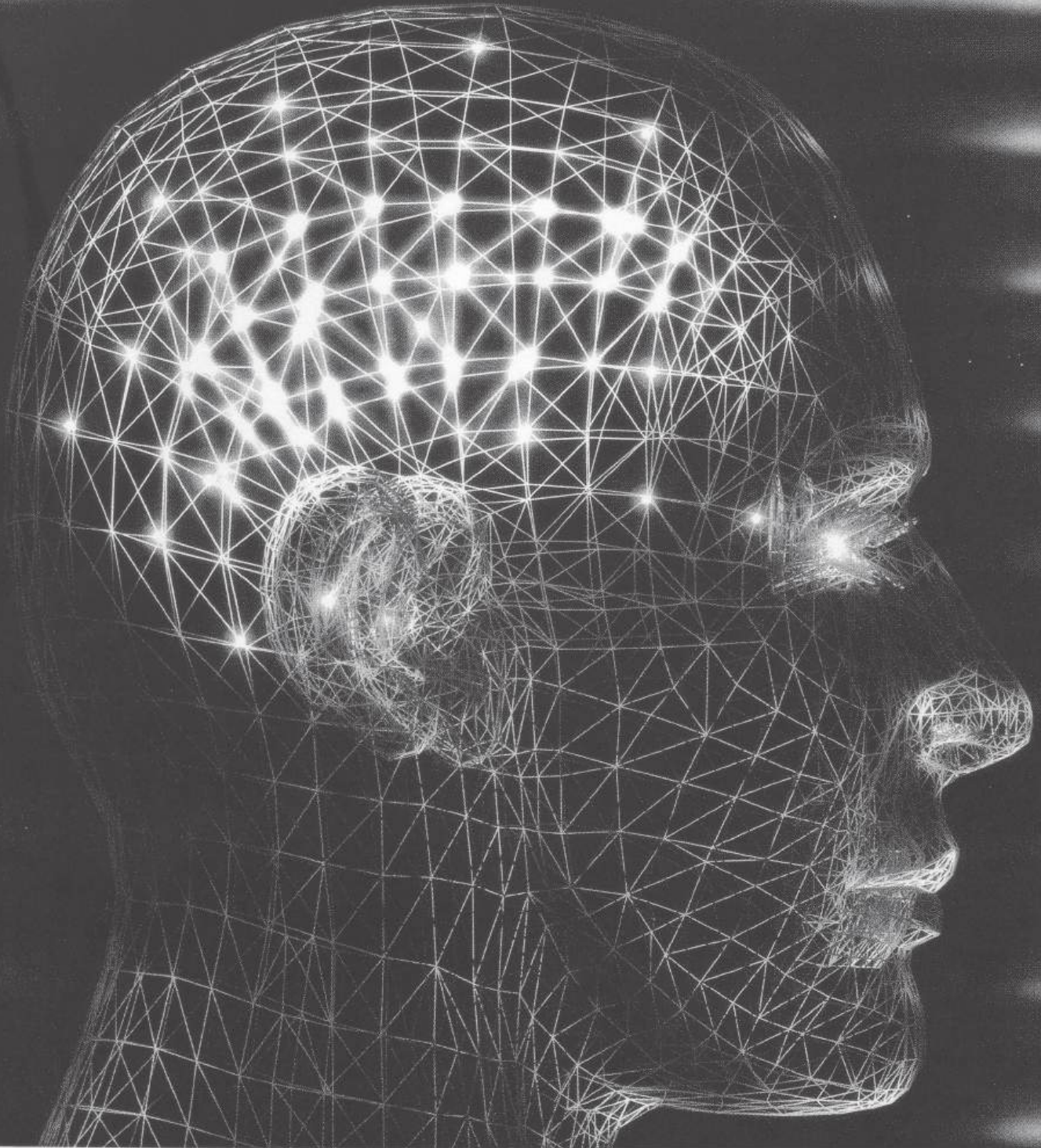


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HOMIE ECONOMICS

Tim O'Brien explains the main considerations in the development of an effective and low-cost sprinkler system for homes in New Zealand

IN NEW Zealand, sprinklers have been widely applied in commercial and industrial buildings as an acceptable solution to the fire protection requirements of the New Zealand Building Code (NZBC). Regulatory requirements, financial incentives and business risk management advantages have increasingly driven the installation of automatic sprinkler protection in this context.

However, the situation is quite different for domestic applications. It is uncommon to have sprinklers installed in New Zealand homes because they are not required under legislation, there are no financial incentives for homeowners to install them and the benefits of sprinkler protection are not widely understood by the general public. Indeed, the problem of fire protection is not a consideration for many homeowners – this aspect of house design is left entirely to the building designers as required to meet the provisions of the NZBC.

The perception among homeowners seems to be that fires do not pose a significant risk to either life safety or property. This situation can be partly explained by the fact that fires in domestic premises are a rare occurrence in New Zealand.

Recent statistics show that there are between 20 and 30 deaths are attributed to domestic building fires every year (accounting for just over 0.1% of all deaths). The number of fires causing damage to domestic property is also relatively rare. High cost is also a factor that may dissuade a homeowner from installing sprinkler protection.

Low-cost system

However, despite this situation, the New Zealand Fire Service Commission (NZFSC) recognises that fitting automatic sprinklers is one of the most effective methods of protecting both people and property from fire, and has been keen to promote the development of a low-cost sprinkler system for homes.

In 1999, the NZFSC commissioned the Building Research Association of New Zealand (BRANZ) to carry out a research project aimed at identifying an inexpensive domestic fire sprinkler system. The findings of the project were published by the Commission in August 2000 in a report, *Cost effective*

domestic fire sprinkler systems. The report was based on a combination of statistical studies of fires in both New Zealand and the United States, and on testing carried out by BRANZ. It outlined a low-cost domestic sprinkler system that could be fitted in houses, by combining the sprinkler pipework with the domestic cold water plumbing services, and omitting sprinklers in certain spaces where statistics indicated that fatal fires do not originate.

The report provided the impetus for the fire protection industry in New Zealand, in co-operation with the plumbing industry, to prepare a new standard, NZS 4517: *Fire sprinkler systems for houses*, which was published in 2002 (see p.54).

In order to communicate the findings to the country's building sector, BRANZ issued a design guide, *Sprinklers for houses – combination domestic plumbing and fire sprinkler systems*, in September 2002. The guide incorporates the findings of the research and offers a simple and cost-effective way of providing sprinklers in homes.

Design considerations

The system described in the guide is largely compliant with NZS 4517. The design concept is not new – it is based on the use of listed residential sprinkler heads using water from a combined domestic and sprinkler reticulation system fed from an adequate supply (usually the public main). For a three bedroom single-storey dwelling a typical installation during construction has been costed at about NZ\$1,000 (£337).

The following factors were important considerations in the development of the design guide:

Installing the protection where fire is most likely to occur

Almost 90% of house fires that lead to fatalities in New Zealand start in lounges, kitchens or bedrooms. Fires that start in bathrooms and spaces that are not usually inhabited, such as ceiling spaces and under-floor areas, account for very few fatal fires. Economy can be achieved by limiting sprinkler coverage to those areas where fires are most likely to occur without unduly reducing the protection afforded.

Designing for the probable area of sprinkler operation

A sprinkler's minimum demand area in commercial designs is quite large when compared with the typical floor areas of houses. To comply with New Zealand standards, the minimum demand area for an open-plan office with no unusual fire hazards or bulk storage is 84m². Protecting a demand area this size requires the simultaneous operation of multiple sprinkler heads. This places relatively high demands on the water supply and requires relatively large water reticulation pipework when compared with the requirements of domestic water supplies. However, demand areas in houses can be significantly reduced without adversely affecting the protection because most fires in sprinklered facilities are controlled (and often extinguished) by the operation of just a single sprinkler head. The extent of fixed partitioning in a typical home is an important factor in limiting the number of sprinkler heads that are likely to operate in a fire. The demand area in houses where there are large open-plan areas requiring multiple sprinkler heads to ensure adequate coverage has been extended to require the simultaneous operation of two sprinkler heads.

Integrating the sprinklers with the other plumbing

To achieve best economy, the solution set out in the design guide integrates the supply and reticulation pipework for the sprinkler and the domestic water supply. Installation of a combined system is cheaper and less intrusive than retrofitting sprinkler protection into an existing building. It has many other advantages, including:

- with appropriate design the need for back-flow prevention can be avoided, subject to requirements of the local territorial authority. The requirement for back-flow prevention with stand-alone sprinkler systems stems from the possible introduction of stagnant water from the sprinkler pipework back into the public supply. With combined systems, dead ends can be avoided by using short branch lines, a domestic supply point at the hydraulically remote point and/or looped reticulation systems
- there is no requirement for a sprinkler control or alarm valve. Only a single public supply connection is needed with a single isolation valve. This has the added benefit that water supply impairments caused by closed valves, or a significant reduction in water pressure, is likely to be detected through domestic water use. Domestic water requirements should also provide the incentive to have any water supply problems investigated and remedied at the earliest possible time

- materials (piping and fittings) and installation time can be minimised

One disadvantage of a combined system is that raising local and remote alarms from an alarm check valve or flow switches is not practical since domestic water use would result in alarm conditions – an issue that is recognised in the design guide, which identifies the value of smoke detection and recommends that smoke detectors are installed in addition to sprinkler protection.

Flexible plastic pipe

Provision has been made for the use of a range of listed plastic pipe systems utilising crimp, press fit 'O' ring and adhesive-based fitting techniques. Plastic pipe is cheaper than more traditional pipe materials, it has higher C factors resulting in reduced hydraulic losses and it is easier to install.

Design and installation

The design and installation of fire sprinkler protection for commercial premises has required the expertise of approved designers and specialist fitters. Involving these people in the design and installation of domestic sprinkler protection systems would impose additional costs. Yet traditional trade and professional groups involved in the construction of domestic housing, such as plumbers and architects, have the expertise to do this work. It is worth noting that many existing commercial sprinkler installations are based on



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tabular scheduled designs. These systems tend to be more robust than hydraulic designs that have been iteratively optimised for hydraulic performance and material use.

The design guide incorporates a step-by-step guide for the design of combined residential sprinkler systems using head-by-head calculations. A training course is also being developed, targeted at the domestic housing construction industry in New Zealand. BRANZ are considering the development of other tools, including scheduled design rules and a hydraulic design package specific for residential systems.

Minimum maintenance

One of the reasons that automatic sprinkler protection has been so effective is that sprinklers can be expected to operate effectively after extended periods without maintenance, providing that the water supply remains available and adequate. With combined systems and modern materials there is virtually no maintenance liability and the water supply availability is confirmed with every domestic use.

Residential sprinkler protection is primarily for the benefit of the houseowner and occupier. Currently, the only compliance issues for residential sprinkler installations in New Zealand are the territorial authority's requirements for approving water supply connections to the public supply. The onus for the design adequacy of a residential sprinkler rests with the system designer and is documented in the design. The responsibility for installation acceptance and testing of the water supply lies with the installer, documented through the installation producer statement. The need to ensure that the system remains adequate in terms of coverage, maintenance and water supply adequacy rests with the owner and occupier.

Although low-cost automatic sprinkler protection is now available to New Zealand homeowners, the public's perception of fire hazards, combined with a lack of knowledge about the operation and effectiveness of sprinklers, is unlikely to provide the impetus for a significant increase in the number of residential sprinkler installations. Overseas experience suggests that regulation may be necessary to ensure that effective sprinkler protection is an essential feature in the modern home □

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The NZFSC report, Cost effective domestic fire sprinkler systems, can be found at: www.fire.org.nz/more_info/reports/fund/reports/Report_1.htm

The BRANZ design guide, Sprinklers for houses – combination domestic plumbing and fire sprinkler systems, can be obtained from the BRANZ website: www.branz.co.nz

The New Zealand standard, NZS 4517:2002: Fire Sprinkler Systems for Houses, can be obtained from the Standards New Zealand website, www.standards.co.nz