Research & Development Highlights

Technical Series
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Costs and Benefits of Installing Fire Sprinklers in Houses

Introduction

The National Building Code of Canada requires smoke alarms to be installed in all new homes built in Canada. To further protect Canadians from fire, some Canadian groups, including fire-safety experts, fire marshals, fire commissioners and various municipal officials, are now advocating that the National Building Code be changed to make sprinklers mandatory in new houses. Installing sprinklers would be costly and would reduce the affordability of new houses. The added cost could be justified if the resulting savings in lives and property damage were sufficiently high. To determine these savings, CMiHC commissioned a study to determine the costs and benefits of installing sprinklers in new houses.

Approach

The objective of the study was **to** assess the cost-benefit of sprinklers in new housing only.

The benefits of sprinlders were compared with costs **to** determine the net cost (or benefit) of installing sprinklers in all new houses.

The benefits considered were reductions in:

- fatalities,
- injuries and associated costs,
- property loss,
- indirect costs, and
- the costs of fire service.

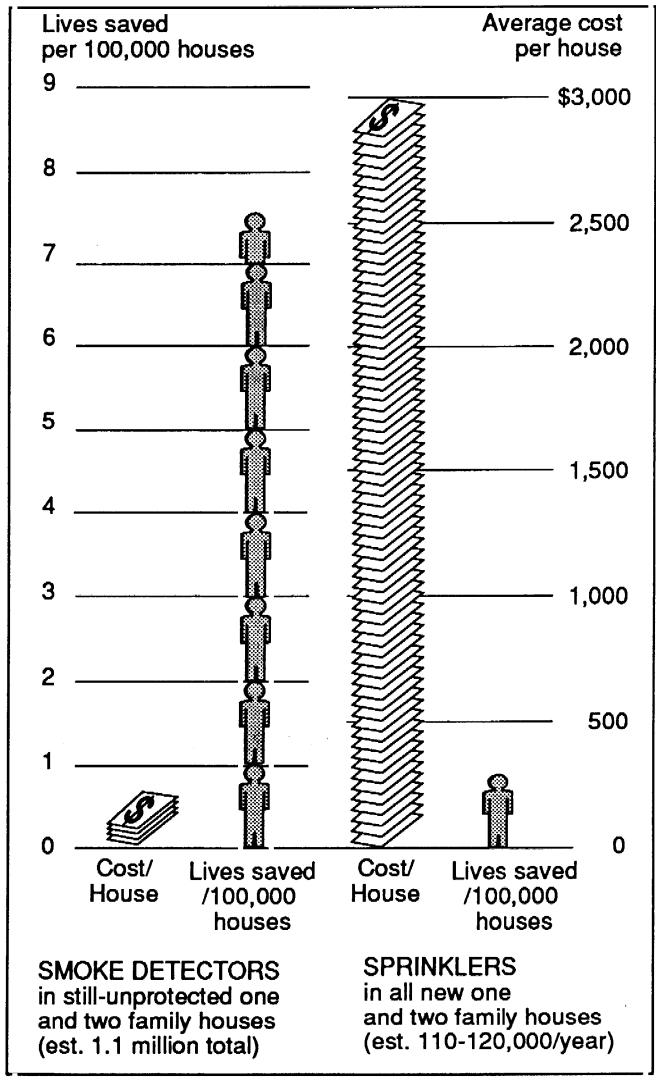
The costs considered were:

- installation, and
- maintenance.

Risk Assessment for Newer Houses

Data comparing fire fatalities in old and new houses indicates that newer houses have fewer fatalities than older houses, and that the fatality rate is declining. The fatality rate for the entire housing stock (that is, new and old houses) is about 3.5 times greater than that of newer houses alone.

There are many factors—physical, social and economic—which may be partly responsible for the lower death rate **in** newer homes. The most significant is the widespread use of smoke alarms. The study did not find evidence to suggest that newer houses will become less safe as they age. One indication that newer houses will have fewer fires is the trend toward reduced fatality and property loss rates despite the growth in the housing stock. Between 1980 and 1987, fatality and property loss rates continually decreased. These figures probably reflect, among other



Impact of policy alternatives

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things, more fire-resistant upholstery fabrics and bedding, fewer occupants per house, fewer smokers and safer electrical appliances.

Benefits of Sprinklers

Reduced fatalities

It is difficult to estimate how much safer sprinklers would make houses. Based on evidence from laboratory studies and limited field experience in the U.S., however, the study suggests that sprinklers could save an additional 7.7 lives per million houses per year. The evidence also suggests that sprinklers could reduce the risk of firefighter fatalities. it is estimated that if all new houses were installed with sprinklers, about 0.1 firefighter lives could be saved per million houses per year. Thus, the study concludes that sprinklers could save an additional 7.8 lives per million houses per year.

Reduced injuries

Based on U.S. research, the study suggests that the addition of sprinklers in new houses could prevent about 87 injuries per million houses each year. Firefighter injuries could also be reduced through increased installation of sprinklers by as many as 30 injuries per million houses per year. Based on American studies, the cost per injury to a civilian or firefighter is $30,000.00 (1989 Cdn). These costs reflect direct medical bills and allowance for pain and suffering.

Reduced property losses

Very little information exists to demonstrate the effectiveness of sprinklers in reducing fire losses. One U.S. study indicates that the combination of a smoke alarm and sprinkler system could reduce property loss by approximately two-thirds. Based on this one source, the study concludes that sprinklers in Canadian houses could reduce property losses to an average loss of $15.68 per house per year.

Reduced indirect costs

Indirect costs must also be factored in to total loss attributed to a fire. These costs include expenses such as temporary shelter or missed wages. The study estimates that indirect property losses in all Canadian houses without sprinklers would be about $2.90 per house per year. Subsequently, the reduction of indirect fire-related costs associated with installing sprinklers would be approximately $1.02 per house per year.

Reduced fire service costs

It has been argued that because residential sprinklers reduce the severity of fires, community fire services could be reduced. Such a reduction should also reduce community taxes. However, some studies indicate that firefighting services represent only a portion of the total service provided by firefighters. Therefore savings as a result of installing sprinklers would be minimal. The study consultant reviewed several models and studies and concluded that an eventual reduction of *25%* could be realistically anticipated if sprinklers were installed in all new houses. Since the residential portion of firefighting costs is about 40%, a *25%* reduction would yield a total saving of 10%. The study assumed that the typical cost per household for all of the services provided by municipal fire services was about $180.00 per house per year. As a result, the installation of sprinklers represents a saving of approximately $18.00 per house per year.

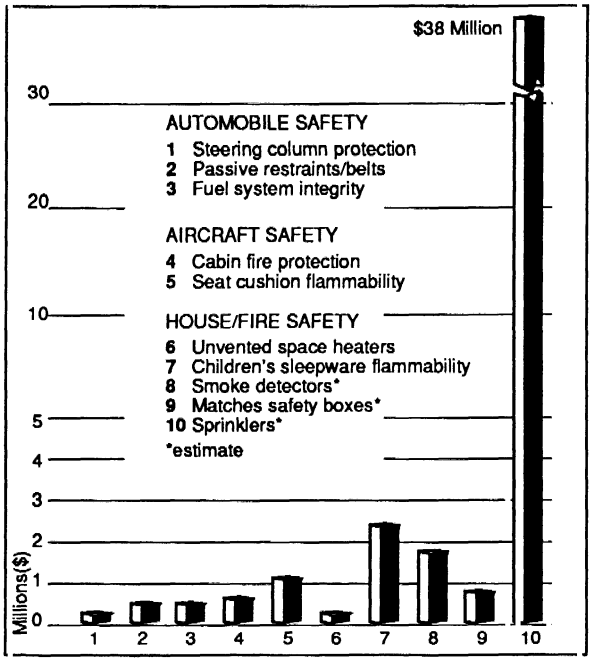
Cost for Sprinklers

Installation

Depending on key factors such as the type of pipe used (copper or plastic) and location (using municipal water supplies in urban centres or private wells in rural areas), costs associated with the installation of a sprinkler system could range from $2,800 to $6,700.

Maintenance

Annual inspection fees were estimated at approximately *$35.00.* Due to insufficient data with regard to water damage costs associated with sprinkler failure, no allowance for water damage was included in the study.



Mandatory Regulations – Cost per life saved

Other Cost and Benefit Considerations

The study did not include reductions in insurance premiums as a result of installing sprinklers because it was assumed to be included in reductions of property loss.

It has been argued that sprinklers would allow for relaxation of some fire-related building code requirements (for example, fire protection ratings and increased allowable distances to exits). The study concluded, however, that building code requirements are already minimal and could not be further relaxed.

Conclusions

The study concluded that the cost of saving one life would be at least $38 million. Higher installation costs would increase that cost. The study also concluded that:

- The risk of fire is greater in older houses than in newer ones, although the rates of fatalities, injuries and property loss for all houses are steadily declining.
- Two categories of the population appear to be at particular risk to fire--the very young and the elderly.
- Factors unique to different socioeconomic groups may influence fire risk factors between different groupings.
- Smoking and children playing with matches are the major causes of fires that have fatalities.
- Canadian statistics on fires in all types of buildings are significantly lacking.
- In new housing, sprinklers might save approximately 7.7 occupant lives per million houses per year, and 0.09 fireman lives per year.
- It is doubtful that the installation of sprinklers in houses will create a significant reduction in municipal firefighting services.
- The use of sprinklers in high-hazard areas only (such as bedrooms, living rooms and kitchens) is not more cost-effective that installing a full system.
- The development of a full or partial sprinkler system that uses lower residential water pressures and needs no special service piping should be examined as a potentially promising measure for existing high-risk housing.
- Targeting safety measures to high-risk housing and usage may be fruitful (such as houses occupied by persons 75 years and older or lower-income groups).
- The remarkably high incidence of fires associated with children playing with matches suggests that the development of childproof match dispensers should be investigated. This approach would be similar to that taken with medicine dispensers.
- Fires associated with cigarette smoking appear to be the most deadly and are the largest single cause of fatal fires. This circumstance greatly relates to the ignition of fabrics. Therefore, further steps toward increasing fire safety characteristics of upholstery, drapery and bedding fabrics may be cost-effective.

Housing Research at CMHC

Under Part IK of the National Housing Act, the Government of Canada provides funds to CMHC to conduct research into the social, economic and technical aspects of housing and related fields, and to undertake the publishing and distribution of the results of this research.

This factsheet is one of a series intended to inform you of the nature and scope of CMHC's technical research program.

Project Manager: Jacques Rousseau

Research Report: Analysis of the Cost Benefits of Installing Fire Sprinklers in Houses

Project Consultant: A.T. Hansen, Scanada Consultants (CMHC, June 1989).

A full report on this research prolect is available from the Canadian Housing Information Centre at the address below.

This Research and Development Highlights factsheet is one of a wide variety of housing-related publications produced by CMHC.

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