

During the immediate years preceding 2000, anecdotal evidence suggested that the transfer of moisture and heat loss through the recesses required for the fitting of downlights compromised compliance with New Zealand Building Code Clauses C1 "Outbreak of fire", E3 "Internal moisture" and H1 "Energy Efficiency".

The extent of the evidence was sufficient to convince the BIA that the matter should be investigated and researched. The research project commenced in July 2000 and reported on in December 2001¹.

Areas of investigation

The specific issues investigated and researched were:

Product availability

- The different types of downlight available on the market.

Clause C1

- The potential for overheating and ignition of insulation or other building elements.

Clause E3

- How much moisture is transferred into the attic space by downlights while considering the variations of openings of different types of downlights, when used in the following areas:
 - Living areas (lounges, dining, bedrooms and hall areas)
 - Wet areas (bathrooms, laundries and kitchen areas).

Clause H1

- How much heat loss occurs through downlights when:
 - Insulation butts up to the outside of the downlight fitting
 - Insulation is kept 100 mm away from the downlight fitting.
- What happens when the same downlight is installed in a skillion roof.
- What happens when the same light is installed in an inter-floor space including suspended ceiling spaces.

Research procedure

The research was carried out in five stages:

1. Searching for existing published data
2. Investigate the types of downlight commonly available in NZ
3. Designing and constructing a test room, test apparatus and data logging equipment
4. Testing and gathering of data
5. Analysis of results and production of a report.

The general testing procedure was as follows:

NZEC 54: 2001 New Zealand Electrical Code of Practice for the installation of recessed luminaires and associated equipment

- The test room was tested initially and at regular intervals throughout the testing period, without light fittings installed, to establish heat and moisture loss through the test room fabric.
- Each type of fitting was tested in turn and the amount of moisture transferred and heat loss measured. Losses due to conduction, convection and diffusion were measured.
- Similar tests were also conducted for inter-floor and suspended ceiling spaces.

Conclusions

The conclusions from the heat loss testing were:

- Heat loss through light fittings owing to conduction is not significant.
- Where there are no large internal pressure differences (e.g. caused by wind around the house), heat loss owing to convection currents set up by the light fittings in operation is minimal.
- Heat loss through fittings is most significant when there are pressure differences across the light fittings.

The conclusions from moisture transfer testing were:

- For habitable areas in dwellings having skillion and/or pitched roofs, moisture transfer is not likely to cause problems, providing the means of ventilation of the building complies with the Building Code. However, further research into roof space ventilation is required before this can be confirmed.
- In moist areas, such as bathrooms and laundries, problems regarding moisture will eventually be experienced (even with closed types of downlights). Within inter-floor spaces there will be direct and indirect effects because of the space becoming saturated, especially if the upper floor area is not heated. Similar effects are likely to occur in suspended ceiling spaces. Within pitched and skillion roofs there will be localised condensation on the fitting and building elements.
- For open and restricted types of fitting the free area (i.e. the effective opening around the lamp itself) depends on the correct type of lamp being installed and this is a factor to consider when these types of light fitting are retrofitted with different lamps such as energy efficient compact fluorescents.

The tests showed that the surface temperature of the downlights tested could reach values of around 125-150°C. These temperatures will harm electrical cables. Therefore, it is important to ensure that the wiring to the fittings is done strictly in accordance with the manufacturer's instructions and the electrical wiring regulations. The tests indicated that if the downlights are installed in accordance with NZECP 54² the fire risks are negligible.

NZECP 54 is a document that provides installation methods that will improve electrical and fire safety factors and ensure the durability of adjacent building elements.

Summary

NZECP 54: 2001 New Zealand Electrical Code of Practice for the installation of recessed luminaires and associated equipment

If downlights are selected and installed in accordance with NZECP 54 using 'C' and 'R' types heat losses through the light fittings will be insignificant. The major path for heat and moisture losses is by airflow across fittings from infiltration pressures caused by wind effects. Open-type fittings could allow significant air movement and heat loss to the roof spaces under windy conditions.

Moisture transfer from habitable spaces is not likely to be a problem if the fittings are installed in accordance with NZECP 54 and if the building's ventilation complies with the Building Code. Moisture transfer from moist areas to inter-floor and suspended ceiling spaces has the potential to cause undue dampness. The research also indicated that downlights fitted in moist areas of buildings with skillion or pitched roofs may have the potential to cause undue dampness.

Outcomes to date

Acceptable Solution E3/AS1 "Internal moisture" is currently under review. Included in the review is the inclusion of a new paragraph in the acceptable solution dealing with the installation of downlights. The content of the paragraph is based on the requirements of NZECP 54 and the findings of the research undertaken. An extract from the proposed paragraph is as follows:

4.1.1 Preventing the transfer of moisture

Where recessed luminaries are installed in bathrooms, laundries, and other spaces where moisture may be generated or accumulated, they shall be of a type that prevents the transfer of moisture into concealed spaces by being:

- a) Physically enclosed or sealed and rated suitable for use in moist areas; or
- b) Of the **(C) Closed** type as defined by NZECP 54; or
- c) Of the **(R) Restricted** type, as defined by NZECP 54, where the space is provided with adequate mechanical ventilation, in accordance with the New Zealand Building Code clause G4.