A comparison of overheating criteria for a range of building types

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Overheating criteria used:

CIBSE Guide A:

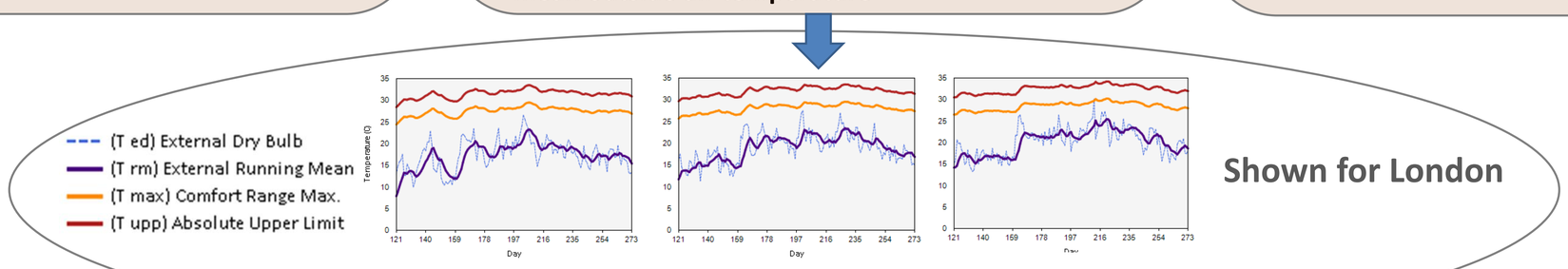
- Uses Design Summer Year (**DSY**) weather file
- Based on **operative temperature**
- Single criteria:
  - Threshold temperature exceeded ≯ 1% of occupied hours per year
- Threshold temperature for bedrooms 26°C, for all other rooms 28°C

TM52 overheating Criteria:

- Uses **DSY** weather file
- Based on **operative temperature**
- Based on three criteria (need to pass two)
  - Threshold temperature exceeded ≯ 3% of occupied hours per year
  - Daily weighted exceedance (degree hours) ≯ 6
  - Temperature ≯ upper limit
- Threshold temperature based on **running mean daily mean outside air temperature**

BB101

- **Only for schools**
- Uses Test Reference Year (**TRY**) weather file
- Based on **air temperature**
- Based on three criteria (need to pass two):
  - 28°C exceeded ≯ 120 hours per year
  - average internal to external temperature difference ≯ 5°C
  - air temperature ≯ 32°C

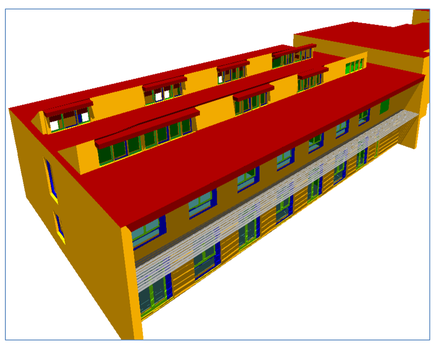


Shown for London

Current weather (DSY) | *2050 weather (*from Prometheus[1] project) | *2080 weather*

Buildings analysed:

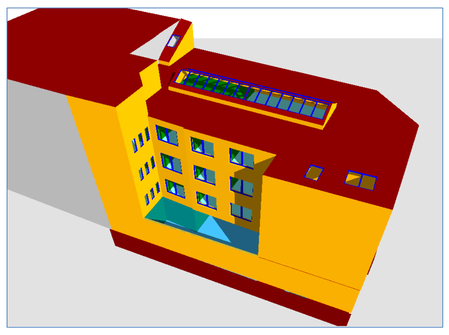
School



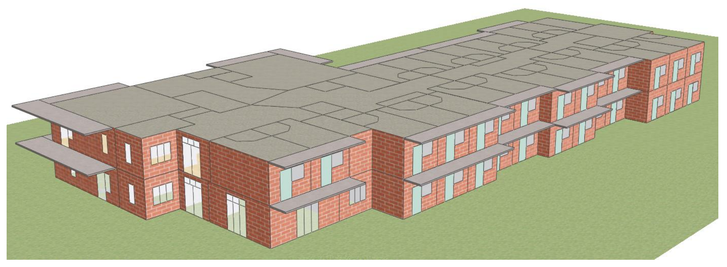
- TM52 Category II building
- Birmingham
- Naturally ventilated
- New build
- Occupied 0900-1530
- 30 pupils per classroom + 2 staff

Office

- TM52 Category II building
- London
- Naturally ventilated
- Refurbishment
- Occupied 0900-1700 weekdays
- 10 m^2 per person



Care home



- TM52 Category I building
- Newcastle
- Mechanical ventilation (8 litres/second to bedrooms)
- New build
- Bedrooms occupied 2200-0800
- Single bedrooms

Results – compliance with criteria

BB101	School Current	School 2050	School 2080
Room 01	Pass	Fail	Fail
Room 02	Pass	Fail	Fail
Room 03	Pass	Fail	Fail
Room 04	Pass	Fail	Fail
Room 05	Pass	Fail	Fail
Room 06	Pass	Fail	Fail
Room 07	Pass	Pass	Fail
Room 08	Pass	Pass	Fail
Room 09	Pass	Pass	Fail
Room 10	Pass	Pass	Fail
Room 11	Pass	Pass	Fail
Room 12	Pass	Pass	Fail

School – BB101

Guide A	School Current	School 2050	School 2080
Room 01	Fail	Fail	Fail
Room 02	Fail	Fail	Fail
Room 03	Fail	Fail	Fail
Room 04	Fail	Fail	Fail
Room 05	Fail	Fail	Fail
Room 06	Fail	Fail	Fail
Room 07	Fail	Fail	Fail
Room 08	Fail	Fail	Fail
Room 09	Fail	Fail	Fail
Room 10	Fail	Fail	Fail
Room 11	Fail	Fail	Fail
Room 12	Fail	Fail	Fail

School – Guide A

TM52	School Current	School 2050	School 2080
Room 01	Fail	Pass	Pass
Room 02	Fail	Fail	Fail
Room 03	Fail	Pass	Pass
Room 04	Fail	Fail	Fail
Room 05	Fail	Pass	Pass
Room 06	Fail	Fail	Fail
Room 07	Fail	Pass	Pass
Room 08	Fail	Pass	Pass
Room 09	Fail	Pass	Pass
Room 10	Fail	Pass	Pass
Room 11	Fail	Pass	Pass
Room 12	Fail	Pass	Pass

School – TM52

Guide A	Office Current	Office 2050	Office 2080
Room 01	Pass	Pass	Fail
Room 02	Pass	Pass	Fail
Room 03	Pass	Pass	Fail
Room 04	Pass	Pass	Fail
Room 05	Pass	Pass	Fail
Room 06	Pass	Pass	Fail
Room 07	Pass	Pass	Fail
Room 08	Pass	Pass	Fail
Room 09	Fail	Pass	Fail
Room 10	Pass	Pass	Fail
Room 11	Fail	Fail	Fail

Office – Guide A

TM52	Office Current	Office 2050	Office 2080
Room 01	Pass	Pass	Fail
Room 02	Pass	Pass	Fail
Room 03	Pass	Pass	Fail
Room 04	Pass	Pass	Fail
Room 05	Pass	Pass	Fail
Room 06	Pass	Pass	Fail
Room 07	Pass	Pass	Fail
Room 08	Pass	Pass	Fail
Room 09	Pass	Pass	Fail
Room 10	Pass	Pass	Fail
Room 11	Fail	Fail	Fail

Office – TM52

Guide A	Care home current	Care home 2050	Care home 2080
Room 01	pass	fail	fail
Room 02	pass	fail	fail
Room 03	pass	fail	fail
Room 04	pass	fail	fail
Room 05	pass	fail	fail
Room 06	pass	fail	fail
Room 07	pass	fail	fail
Room 08	pass	fail	fail
Room 09	pass	fail	fail
Room 10	pass	fail	fail
Room 11	pass	fail	fail
Room 12	pass	fail	fail
Room 13	pass	fail	fail
Room 14	pass	fail	fail
Room 15	pass	fail	fail

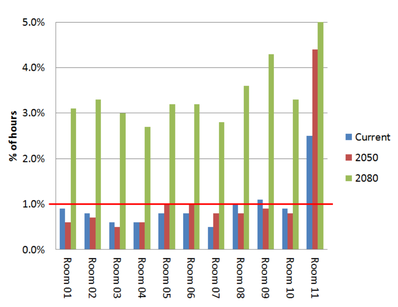
Care home – Guide A

TM52	Care home current	Care home 2050	Care home 2080
Room 01	pass	pass	pass
Room 02	pass	pass	fail
Room 03	pass	pass	pass
Room 04	pass	pass	pass
Room 05	pass	pass	fail
Room 06	pass	pass	pass
Room 07	pass	pass	pass
Room 08	pass	pass	pass
Room 09	pass	pass	pass
Room 10	pass	pass	pass
Room 11	pass	pass	pass
Room 12	pass	pass	pass
Room 13	pass	pass	pass
Room 14	pass	pass	fail
Room 15	pass	pass	fail

Care home – TM52

Results for each criteria for office

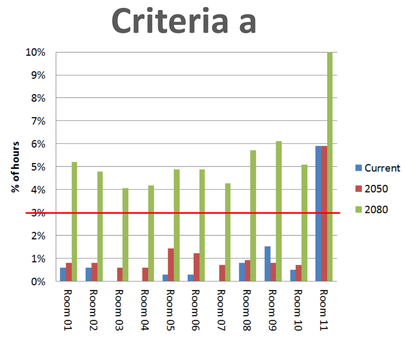
CIBSE Guide A



Guide A - % of hours exceeding 28°C

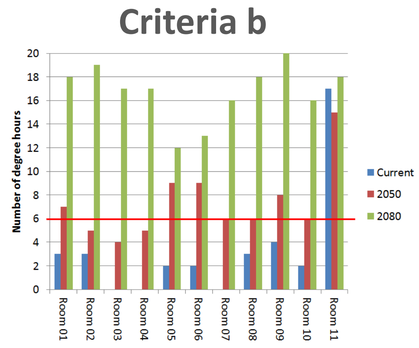
TM52

Criteria a



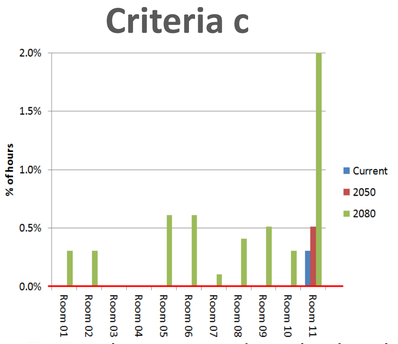
TM52 - hours exceeding comfort range (%)

Criteria b



TM52 – peak daily weighted exceedance (degree hours)

Criteria c



TM52 – hours exceeding absolute limit (%)

Conclusions

- All buildings tested fail to comply with **Guide A** under 2080 weather
- Care home and school also failed to comply with **Guide A** under 2050 weather
- As expected, with a fixed temperature threshold, **Guide A** criteria is more difficult to pass using future weather
- For school, **TM52** compliance is achieved for most rooms using future but not current weather
- For office and care home, 2050 **TM52** results are the same as those using current weather
- However, less of the rooms comply with **TM52** using 2080 weather
- **TM52** *generally* appears less stringent than Guide A under future weather scenarios
- Different criteria show different patterns of compliance with changing weather
- **BB101** appears most lenient under current weather
- It should be noted that **CIBSE TRY, CIBSE DSY and Prometheus** weather files are derived using different methodologies

Ideas for further study

- Test overheating criteria on a wider range of buildings
- Investigate effect of different weather file parameters on overheating

[1] files used Years 2050 and 2080 , 50th percentile, medium scenario DSY files
See http://emps.exeter.ac.uk/research/energy-environment/cee/projects/prometheus/