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IEQ PERFORMANCE GAPS: FAILURE MODES, LITIGATION RISKS, AND THE NEED FOR QUALITY

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INTRODUCTION

There is much evidence that current building industry process does not deliver the intended outcomes[1]. Performance gaps exist including IEQ failures which have resulted in litigation. These performance gaps and litigation are likely to increase due to the move towards more advanced buildings and systems, changes in local weather, and the increasing availability and use of post occupancy performance monitoring. While there are many initiatives aimed at improving industry process, none of these directly address the quality issues[2]. It is proposed that a quality systems approach similar to that of other more performance sensitive industries could provide a solution.

IEQ RELATED LITIGATION

Two high profile cases where litigation has been reported have been: where high humidity in dwellings was related to childhood asthma through moulds and dust mite feces[3], and where high indoor temperatures in schools resulted in unacceptable environments for teachers and pupils[4]. The high humidity case was associated with improvements to existing buildings which did not adequately deal with moisture[5] the overheating problem in schools was reported as being due to inadequate ventilation design. These high profile cases made national headlines due to their scale but can be viewed as the tip of an iceberg of smaller legal disputes.

PERFORMANCE GAPS

In the two cases highlighted above the cause of the performance gap was attributed to inadequate ventilation. The investigators of the high humidity and asthma problem evaluated mechanical ventilation system as a solution with positive effects[6]. Unfortunately there is evidence that mechanical ventilation systems are often not correctly implemented and may not achieve the intended results[7]. The trend in UK towards increased construction air tightness is placing increased reliance on designed ventilation openings and user behaviours, a recent Scottish Government research project identified that in dwellings built to the most recent regulations CO_2 levels routinely exceeded recognised targets and building users did not make effective use of the available ventilation devices[8].

Overheating problems have been widely reported in recently constructed dwellings, even those which have been designed using best practice ventilation and shading. Contributory factors found in these cases have included high internal gains from poorly insulated solar hot water systems etc.

INDUSTRY PROCESS: ADDRESSING PERFORMANCE GAPS?

The conclusion from multiple studies is that failures are common across the buildings industry. In the UK the Soft Landings[9] process has been developed to address the performance gaps, this involves a contractual 2 or 3 year post occupancy performance monitoring period and is based on the 'sea trial' concept of the ship building industry. While this is a step in the right direction this is a case by case solution which accepts that buildings cannot work correctly first time and may not avoid problems occurring in the first place.

The BIM initiative is proposed as a mechanism for upgrading the buildings industry process based on more advanced processes in other industries such as retail, aerospace, automotive and electronics[10] but has so far not addressed the performance issues.

It has been proposed that processes from more performance sensitive industries identified as BIM benchmarks can provide a solution. These industries adopt a quality systems approach where potential failure modes are assessed, and measures to avoid these risks are implemented in the design and construction process. They also adopt robust design approaches where variations in weather and user behaviours are taken into account.

DISCUSSION AND CONCLUSION

Current focus is on performance ratings of buildings based on design features and assumed performance, this has not driven the industry to produce 'real' performance. The accelerating change in building standards has introduced new and complex requirements which is placing further strain on the industry. The performance gap is becoming more apparent due to better measurement and awareness. There will be increasing litigation until the industry process is improved. There are templates for improved processes from other industries that can be adopted.

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