GUIDANCE ON SELECTING THE CORRECT RAINFALL INTENSITY

INTRODUCTION

Selecting the correct rainfall intensity is crucial to carrying out an effective and safe design for the roof drainage components on a building. After blockage by debris, poorly selected rainfall intensity is the leading cause of water ingress into buildings from gutter systems. Unless the design process is understood, the design can be significantly under what is required and can result in regular flooding; or the design can be significantly over what is required, and excessive materials used and/or a siltation risk can be generated. Therefore, rainfall intensity design is the critical first step in any roof drainage design.

Selecting the correct rainfall intensity is essential

The key thing to note about design rainfall in the UK is that it is based on summer thunderstorm conditions, thus it is of very short duration (two minutes) and is heaviest in the driest parts of the country, where the worst thunderstorms are seen. Design rainfall in the north of Scotland will be less than half the value in London and the south east, which may surprise those not familiar with the process.

UK STANDARDS

In September 2000, British Standards Institute published the UK version of a pan-European standard for roof drainage BS EN12056-3:2000 *Gravity drainage systems inside buildings. Roof drainage, layout and calculation*. However, many years after publication there is still a lack of knowledge of the key changes that BS EN12056-3:2000 ushered in, specifically those around the area of rainfall intensity and specifications to the old, obsolete standard are sometimes still seen.

The UK is unusual in that varying rainfall intensities are used based on geographical location and risk to building contents, unlike many areas of Europe where a single blanket rainfall intensity is used for the whole country and any building type.

This means that all the information a user needs to determine the correct rainfall intensity for a given project is contained right at the back of the standard in National Annex NB starting on page 51.

This can be highly confusing as a novice user may look at the section on the first real page of the standard relating to rainfall intensity assessment method which does not apply in the UK at all.

RISK CATEGORIES AND BUILDING LIFE

UK design practice is based on assessing the risk of overflow to the building, and then assigning one of four risk categories:

Category 1: External gutters only - reaches maximum capacity in a one-year storm

Category 2: Normal inboard gutters - reaches maximum capacity in a storm 1.5 x the building life

Category 3: Inboard gutters in important buildings - reaches maximum capacity in a storm 4.5 x the building life

Category 4: Nuclear power stations and archive buildings - this event should never be exceeded.

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However, when working with these categories, some issues are raised:

How is building life determined, is it component life or life the building must be protected against ingress for? In this context the wording in the standard is not particularly helpful, it probably would be better expressed as protection of contents life.

A building may have a time period allowed to replacement/refurbishment of sheeting and roof lights of only 20 years, but in most cases, it would not be acceptable to flood the building contents once every 20 years.

Conversely a building where the construction materials have a very long expected lifespan, but where the contents of the building have no real value, may have a protection life much shorter than a theoretical building components life.

The only logical approach is to determine how often it would be acceptable for the building to flood and then to use that value. Too short and the occupiers will be disadvantaged, too long and the system will be uneconomic. For a building of normal use, 60 years at Category 2 protection is a suitable level of protection.

It could be argued that Category 4 is the best design level to use in all cases, as it will never flood. This is technically correct, however there must always be a balance between protection and cost. An analogy would be driving a tank to work every day. It would be a much safer option for the driver, but would be very expensive, cause more disruption, and would be much less environmentally friendly.

Category 4 is likely to give figures 2.5 times higher than a rainfall intensity derived from a realistic protection life, which on some buildings may make it impossible to drain, on others very difficult, and on all more costly. There is a more serious issue with the use of Category 4 when applied to siphonic drainage, as there is a risk the systems will clog up before they ever really function siphonically. Siphonic systems are laid level and rely on regular flushes of high velocity flow to stay clear. If the systems are designed to Category 4, then it may be 600 years or more between flushes through, by which time they will have clogged up.

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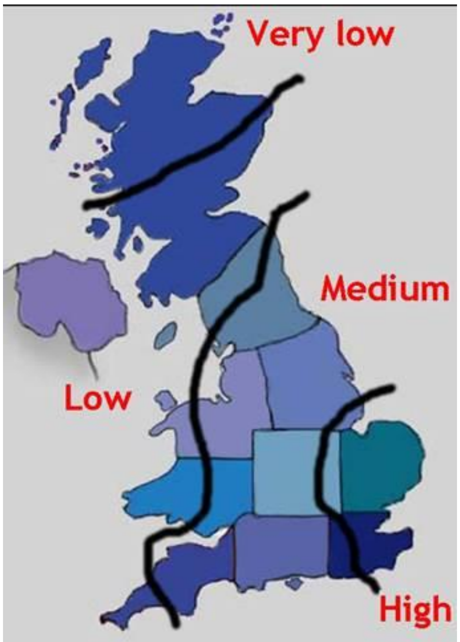
Caution:

One thing to be particularly careful of is the Category numbers. In the previous standard BS 6367, there were five categories, as so what was Category 2 became Category 1, etc, and what was Category 1 moved to a new standard on paved areas. This can lead to issues when a specifier has not fully appreciated the difference and specifies Category 4 on the basis of this being a slightly enhanced level of protection (as it was in BS 6367), rather than the level of rainfall intensity only usually applied to archive buildings and nuclear power stations.

RAINFALL GRAPHS

Once a building protection life has been obtained, the graphs in the national annex can be used to determine a rainfall intensity in l/(s.m^2). This is a change from previous standards which used mm/hr. To get from mm/h to l/(s.m^2) divide by 3600.

There are graphs for 1 year, 5 years, 50 years and 500 years in the standard, and also a more complex procedure which allows rainfall intensity to be calculated for any return period. Most calculation software will use this more complex procedure. The graphs are not very detailed, so some interpolation will be needed, both to locate the site and then work out the rainfall intensity.



Map shows distribution of rainfall levels across the UK

The rainfall intensity can then be multiplied by a catchment are to get a flow rate in l/s, which can be compared to manufactured capacities, or used for more complex detailed design.

Selecting the correct rainfall intensity is critical to the design process, and effort expended at this early stage, will help ensure the correct design later on in the process.

Correct design to BS EN12056-3:2000, in conjunction with adequate maintenance will ensure the roof drainage system does not cause any problems during the life of the building.

MGMA members can advise on design to BS EN12056-3:2000; further advice and guidance is available from any MGMA member company whose details can be found on the MGMA website at www.mgma.co.uk.

REFERENCES

BS EN12056-3:2000 *Gravity drainage systems inside buildings. Roof drainage, layout and calculation*

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