MGMA
METAL GUTTER
MANUFACTURERS' ASSOCIATION

THE IMPORTANCE OF ROOF DRAINAGE CALCULATION

"Developing new standards, regulations and testing methods to ensure products and solutions align to the worst-case scenarios of climate models is essential"

The UK climate is becoming warmer, wetter and windier and extreme weather is now an all-year-round probability in the UK, ranging from flash floods one day to heat waves the next. Average wind speeds are rising faster and, according to the Meteorological Office, the UK could soon see a repeat of the sort of flooding that has hit in recent years after forecasters predicted a one-in-three chance there would be a new record set for monthly rainfall during coming winters.

Damage caused by inadequate roof drainage cam be expensive!

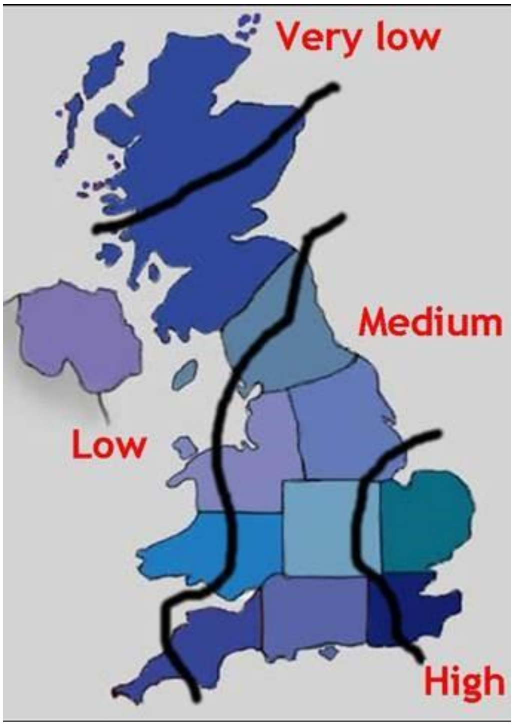
Climate change is one of the key drivers for improving roof drainage and water management. Developing new standards, regulations and testing methods to ensure products and solutions align to the worst-case scenarios of climate models is essential.

Rainwater systems are integral to protecting our buildings and channelling water from roof to ground. Gutters, outlets and downpipes must demonstrate in-situ strength and structural capability when handling increasing volumes of rainfall and wind loadings.

Rainfall intensity design is the critical first step in any roof drainage design. 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.

BS EN12056-3:2000 *Gravity drainage systems inside buildings. Roof drainage, layout and calculation* was published in 2000. The key factor 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.



Distribution of rainfall levels across the UK

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.

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.

However, when working with these categories, some issues are raised. How is building life determined, is it the component life or the 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 for the replacement/refurbishment of sheeting and rooflights 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.

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.

Once a building protection life has been obtained, the graphs in the national annex of BS EN12056-3:2000 can be used to determine a rainfall intensity in l/ (s.m^2). There are graphs for one year, five 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.

Calculating the correct rainfall density is essential

The rainfall intensity can then be multiplied by a catchment area 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. Full details can be found in Guidance Document *GD21 Guidance on selecting the correct rainfall intensity* which can be downloaded from the MGMA web site

The Metal Gutter Manufacturers Association (MGMA) has produced an eaves gutter design flow chart *GD18 Eaves gutter design flow* which enables the user to perform calculations to BS EN12056-3:2000.

By entering simple information relating to building dimensions, geographical location and proposed gutter style, the flow chart will provide guidance on gutter specification. The flow chart is available for download on the MGMA web site.

It is important that rainwater manufacturers offer the relevant support and technical advice to their specifier and installer customers so that metal rainwater gutters are correctly specified across all projects. 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

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This article first appeared in Roofing Today magazine, September 2019

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