GUIDANCE ON METAL RAINWATER SYSTEMS AND UNDERGROUND DRAINAGE

INTRODUCTION

Metal rainwater systems offer an unrivalled ability to cope with extraordinary weather – materials are strong and gutters can be deep with larger holding capacity and improved flow rates. All these features mean a greater ability to cope with and endure our increasingly volatile weather conditions, including surface water flooding.

Understanding how a site will respond to surface water flooding and drainage is now a key factor for local authorities in consideration of planning submissions for property development. All involved in the building process must consider the site at the initial planning stages to identify drainage options and risks.

There is however, a disconnect on many building sites, where the rainwater pipes from roof level meet the ground. It is generally assumed that complications arise at gutter level, and not at ground level, which can lead to so many problems.

The first issue is that ground level is often the line where responsibly changes; the architect, or the cladding company will have designed the above ground drainage, and the civil/structural engineer the below ground. That, in itself, should not cause an issue, but because it is a different team, there is always the chance something will get lost in translation. Thus, good coordination between these two disciplines, bearing in mind that the underground often precedes the above ground in terms of installation order, is essential on all sites, from a small house to a 10,000-square metre industrial building.

UNDERGROUND SUSTAINABLE DRAINAGE SYSTEMS (SuDS)

But it is more than just miscommunication, there are fundamental issues with the way the design is undertaken, which can lead to a mismatch in capacity. Most internal gutters these days are designed for a storm with a return period of between 90 to 135 years. In other words, the rainfall designed for will be so large it would only be expected to occur once within this period - which is a big storm.

Although many underground Sustainable Drainage Systems (SuDS) are now designed to cope with 100-year storms, the pipe systems which take the water to them are commonly only designed for a maximum of 30 years.

That may not seem to make any sense, why design storage to cope with a 100-year event and the pipes for only 30 years? It is all to do with how long the rain storm lasts. The longer the time period that the rain storm lasts, the lower the intensity (the amount of rain that falls each minute) is. Think about a summer thunderstorm, it rains very heavily for a couple of minutes; the intensity is very high, but the overall amount of rain is not that great.

An analogy would be the amount of energy a long-distance runner and a sprinter use. The long-distance runner will use many more calories, but doesn't ever run anywhere near as fast as the sprinter, they just do it for a lot longer time.

The usual design durations are:

Roof drainage – 2 mins
Underground drainage – 5-15 mins
SuDs storage 1-12 hours

This matters; because a 100-year storm running off a 1000m^2 area in London will be:

Roof drainage – 2 mins – 68 l/s
Underground drainage – 5-15 mins – 50 l/s to 29 l/s
SuDs storage 1-12 hours – 12 l/s to 2 l/s

Thus, the SuDS storage may be designed for 30 times less flow than the gutters.

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There is obviously a huge difference between what flows may be allowed in design, and thus, the crunch point is where the underground meets the below ground. There may also be issues with the interface to the SuDs storage which may limit flow rate, which would have a negative effect on the building drainage. So, what can be done?

It is vital that there is good communication between the designers; those designing underground systems need to be aware of just how large the flows may be from the roof and make provision for them, certainly in the first legs from the downpipes.

Many sites now have underground storage tanks which, if poorly detailed, can restrict discharge from roof drainage systems

Poor detailing in SuDS tank (geotextile not trimmed away at pipe entry) limiting flow

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SIPHONIC ROOF DRAINAGE SYSTEMS

For siphonic roof drainage systems it is particularly important that vented manhole covers are fitted on the first manhole, where the siphonic system from the building meets the gravity underground drainage.

This achieves two things; firstly, it ensures that air can be vented from the siphonic systems as they fill, which helps them fill quickly and effectively. Secondly, it ensures that if there is a lack of capacity in the underground system, flow can be harmlessly released onto external surfacing, rather than flooding at high level in the building.

It is vital that any vented lids meet the requirements of BS 8490:2007, with an open area of at least 2 x the incoming pipe area. To achieve this, 'vented lids' with little holes drilled in them are not adequate; full open grate covers, usually used as large highway gully tops, must be used.

Vented manhole lid for siphonic system

However, it is not just siphonic systems which need careful detailing; although less severe problems can occur on gravity systems too. External downpipes should be discharged into gullies, and back inlet gullies with open grates should be fitted to pipes serving internal downpipes.

Both these ensure that if there is a capacity problem in the underground drainage, water can harmlessly escape outside the building instead of backing up the downpipes and cause issues.

The interface with the underground does not have to be a problem area, provided there is attention to detail, and good liaison between all the parties involved.

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 8490:2007 *Guide to siphonic roof drainage systems*

BS EN 12056-3:2000 *Gravity drainage systems inside buildings. Roof drainage, layout and calculation*

MGMA guidance document *GD 06 Siphonic roof drainage*

www.susdrain.org/ - the community for sustainable drainage