

# CPD Seminar Handout:

*A Structured Approach to Roof Specification and Design*



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# A Structured Approach to Roof Specification and Design

CPD handout: August 2017

This document contains the key resources from SIG Design & Technology's RIBA Certified CPD Seminar, A Structured Approach to Roof Specification and Design, in an easy to use format.

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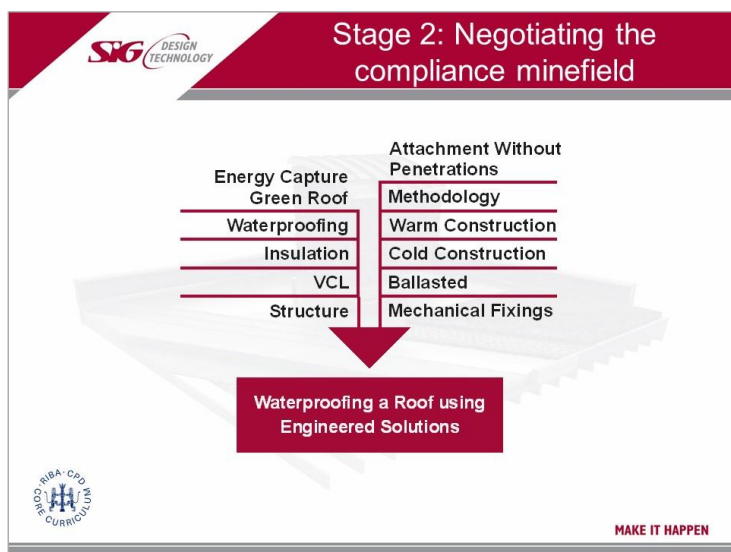


What do you think are some of the design considerations you need to make when specifying a roof?

So first of all – what does the client need this specific roof to do? Its design and construction must meet a matrix of complex and strategic variables.



We're all familiar with these types of documents, they are vital to correct design and due diligence, but how do we ensure compliance when there are so many different standards for any one building element?



## Stage 2: Negotiating the compliance minefield

Once we understand the brief, we can evaluate the options, choose the materials and define the methodology – the job is to waterproof a roof using an engineered solution specific to the project.



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## Stage 3: Finding the solution

Cost + Design + Compliance = Best Solution

Cost

Design / Buildability

Compliance

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### Stage 3: Selecting the correct specification

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## Example 1 – Warehouse with steel frame

- Low cost metal deck
- No roof-mounted plant
- Limited roof plant
- Cost driven
- Short programme

**Solution: High quality single ply waterproofing system**

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## Example 2 – Podium deck

- Concrete construction
- Limited falls
- Circulation area/extended recreational areas
- Design awareness of heavy live loads on structure
- Low maintenance

**Solution: Hot melt waterproofing system**



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## Example 3 – Prestige commercial

- High aesthetic appeal
- Significant investment
- Long durability/life expectancy
- Robust material
- Kerb appeal
- Limited maintenance

**Solution: Pre-formed zinc roofing & cladding**



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## Example 4 – Plant room

- Complex/complicated detailing
- Multiple penetrations in roof
- Difficult access
- Restricted working space
- Cost effective on metal deck refurbishment
- Building to remain in use

**Solution: New hybrid polymer cold applied liquid waterproofing system**



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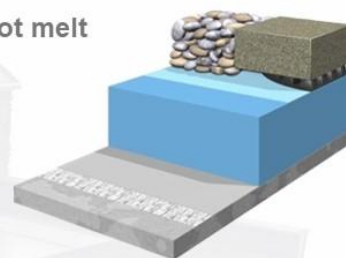
## Waterproofing: Roofing options

## Roofing options

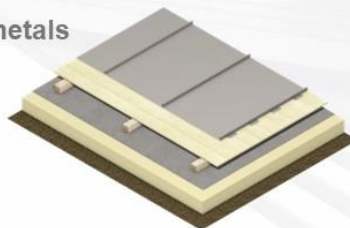
Single ply Membranes



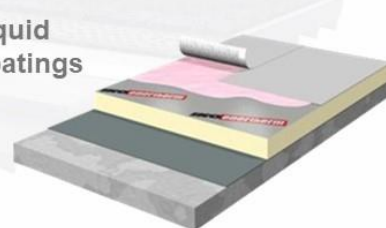
Hot melt



Hard metals



Liquid Coatings



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## Why specify Single Ply?

- Over 50 years track record
  - New build or refurbishments applications
  - Low capital cost and cost in use
  - Safe, rapid, clean installation
  - High durable, long-lasting performance
  - Design flexibility – wave form, cupolas, colours etc
  - Easy repair, modification and refurbishment
  - Simple detailing to suit all situations
  - Well managed and regulated sector (Single Ply Roofing Association - SPRA)
  - Ideal surface for subsequent photovoltaic systems
  - Environmentally friendly & good reflectivity
- Things to be aware of:
- Not the best application when specifying inverted
  - Avoid plant areas with lots of penetrations
  - CDM regulation stipulate a defined not slip walkway for maintenance
  - Make sure its adequately protected during construction



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## Material characteristics of Single Ply

	PVC	EPDM	TPO	TPE	PIB
Bitumen Compatibility	No	No	Yes	Yes	Yes
Colour Range Options	Wide range	Very limited	Limited	Limited	Limited
Solvent Preparation	Yes	Yes	Yes	No	Yes
Contains Chlorine/Plasticisers	Yes	No	No	No	No
UK Manufactured	Yes	No	No	Yes	No
Polymer Recycling	Partial	No	Partial	100%	100%
Track Record	1960s	1970s	1980s	1990s	1930s
Life Expectancy	30 year BBA	25+ years	35+ years	35+ years	35+ years
Ease of Installation	Simple	Complex Detailing	Sensitive to Site Conditions	Very Simple	Simple
Welding Window (hand)	380°C ± 20°C	Taped	280°C ± 20°C	200°C - 600°C	Self sealing edge



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## Why specify Hot Melt?

- Long life expectancy
  - Cost effective
  - Approved contractor scheme
  - No joints
  - Water unable to track under fully bonded system
  - Easy to install
  - Ideal for green roofs on concrete
  - Easy to detect leaks if there's a problem
  - Can be laid on zero falls.
- Things to be aware of:
- Involves hot works
  - Limited substrates
  - Only suitable for inverted roofs
  - Limited number of installers
  - Only 4 manufacturers



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## Material characteristics of Hot Melt

	2 <sup>nd</sup> generation
Bitumen compatibility	Yes
UK manufactured	No
Track record	10 years +
Life expectancy	25 years
Ease of installation	Simple
Cold weather application	Down to -18°C
Solvent content or VOCs	Only in primer
High bond/tensile strength	Yes
Resistance to impact damage	Yes
Cure time	None
Guarantee	35 years



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## Why specify Hard Metals

- Long life span due to natural patina formation
  - Maintenance free
  - Low weight ca. 7,2 kg/m<sup>2</sup>
  - 100% recyclable
  - Zinc is an essential element
  - Zinc titanium production and use has a negligible impact on the environment
  - Excellent BREEAM credentials
  - Dramatic visual impact
- Things to be aware of:
- High Capital cost
  - Compatibility issues
  - Breather membranes specification
  - Hard to retro fit penetrations
  - Limited design standards




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## Material characteristics of Hard Metals

Product requirements	Product requirements to DIN EN 988
Zinc	Zn 99.995%
Yield strength elasticity (Rp 0.2)	min. 100N/mm <sup>2</sup>
Tensile strength (Rm)	min. 150N/mm <sup>2</sup>
Elongation (A50)	min. 35%
Folding test	No fractures on the fold
Full range of Finishes	
Unique UK Guarantee	
Quality management system	
Density	
Trained Contractor Scheme	
Track Record	
Maintenance required	





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## Why specify Liquid Coating?

- Cold applied (no hot works)
- Quick cure
- One component
- Very low odour
- Solvent free
- No isocyanates
- Non hazardous
- Can apply in cold temperatures above 0°C
- Can be applied on moist surfaces (7% or less)
- Water repellent on application

- Fully reinforced (polyester fabric)
- FLL approved (green roofs)
- ETA approval (BBA pending June 2014)
- Seamless waterproofing system
- Ideal for complex detailing
- Excellent elasticity and tensile strength
- Refurbishment or new build projects
- Cost effective wet on wet application



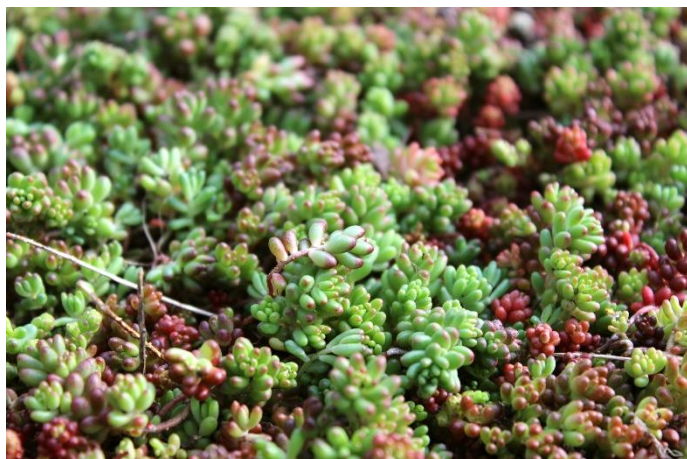
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## Green roofing solutions

### Why specify at green roof?

- It makes good use of space, optimising the structural footprint of a building.
- A green roof captures carbon. It improves air quality by absorbing airborne pollutants through plants removing them from the environment.
- A green roof substantially increases the life expectancy of the roof's waterproofing membrane as it protects from UV degradation and extremes of climatic condition.
- It assists urban drainage.
- It provides thermal and acoustic insulation.
- It provides an additional green space for wildlife.
- And of course a green roof is aesthetically pleasing.
- Green roof membranes require FLL certification. There are two levels; for root and rhizome protection.

## Carbon capture



So does green roofing actually work?

The amount of CO<sub>2</sub> a tree will offset depends on many factors, such as the type of tree, where it is planted and the amount of room it has to grow. On average, one broad leaf tree will absorb in the region of 1 tonne of carbon dioxide during its full life-time approximately 100 years. Broad leaf trees are indigenous to UK.

Per sq. /m hard to measure due to ranging densities of forests, whereas sedum is planted on green roofs and density is a controlled factor.

At this moment we do not know how much CO<sub>2</sub> Sedum is able to absorb, but because of the great amount of sedum leaves per m<sup>2</sup>, we expect this number to be considerable. However, an initial two-year study carried out by Michigan State University in 2009; found that a sedum roof absorbed 190 g/m<sup>2</sup> of CO<sub>2</sub> over a year. From this we can calculate that 50m<sup>2</sup> of sedum absorbs 9,500g p.a.

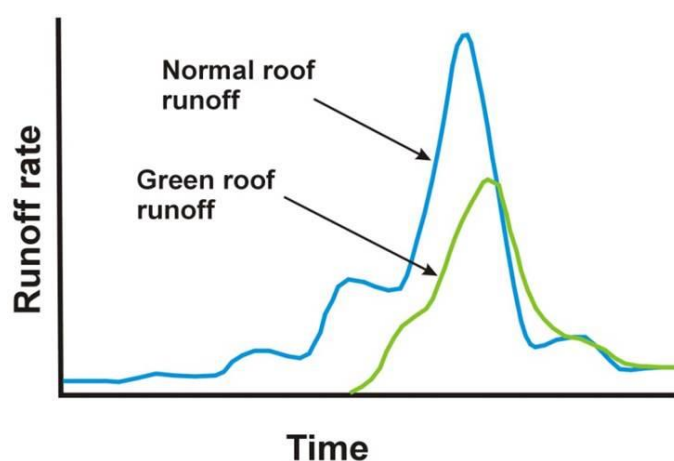
- Medium-sized car generates 1.64t of CO<sub>2</sub> p.a.
- Based on a car travelling 10,000 miles p.a.
- We need approx. 9,000m<sup>2</sup> of sedum per car, or roof gardens with broad leaf trees!

## Green roofs and urban drainage

Green roofs are an important component of SUDS – sustainable urban drainage systems. There is often a requirement to attenuate water that has been shed from roofs into the drainage system.

It's a fact that a typical green roof absorbs and evaporates 50% of the rainfall that falls on the roof.

This rate of absorption reduces the pressure on drains and reduces the likelihood of localised downstream flooding.



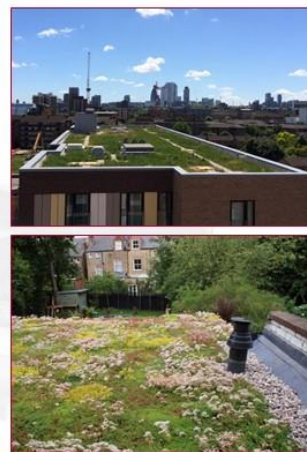
## Biodiverse habitat

Green roofs can make a considerable contribution to conservation of biodiversity. It's important to include mixtures of drought tolerant native wild flowers plus sedums and grasses. Some London boroughs even stipulate which native plants are to be included by postcode! Specific plants are particularly invaluable to some types of invertebrates e.g. bees. There is also evidence of rare birds using green roofs, e.g. the black redstart.



## Why specify a built-up green roof?

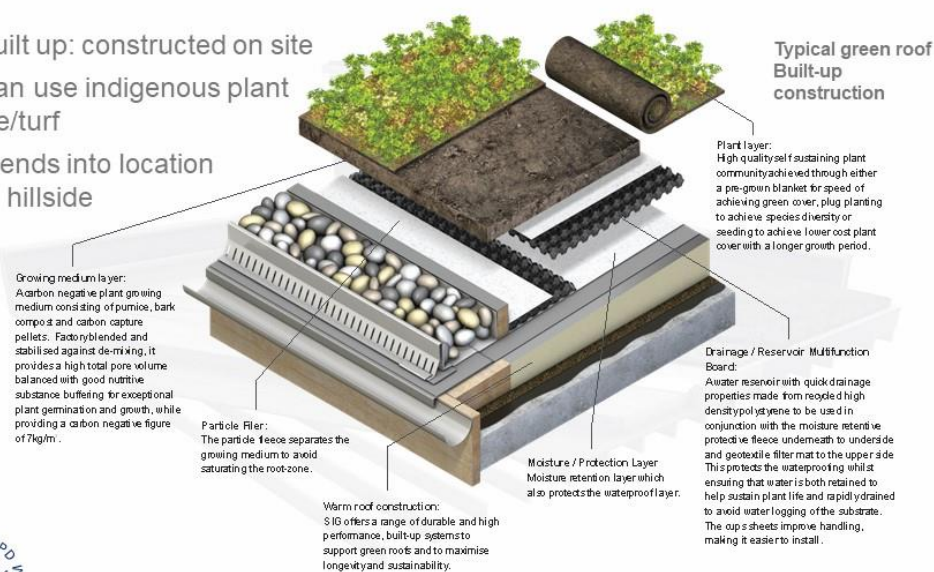
- Substantially increases the life expectancy of the roof's waterproofing membrane
- Improves energy efficiency in a warm roof construction
- Improves sound insulation
- Reduces rainwater run-off
- Reduces heat build-up in urban areas
- Provides an additional green space for wildlife
- Improves air quality by absorbing airborne pollutants
- Makes good use of space – optimising the 'structural footprint'
- Aesthetically pleasing



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## Built up Green Roof

- Built up: constructed on site
- Can use indigenous plant life/turf
- Blends into location or hillside



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## What to expect from suppliers

### Technical support:

You should receive comprehensive technical support from a manufacturer or supplier and this should comply to all relevant standards.

Technical information should include standard details, NBS Specifications, Cut To Falls insulation design, wind load and thermal calculations and third party accreditation.

SIG Design & Technology now has several products as BIM objects available in the NBS National BIM Library.

Early involvement in a project by a supplier will make the membrane system choice and technical support process simpler in the long run.

Suppliers can offer advice, not just on which products to use but more importantly when those products are not suitable and an alternative should be sought.

### On-site support:

A manufacturer or supplier should offer on-site support to protect the long term integrity of the chosen waterproofing system. This is not just important to ensure the long term performance of the waterproofing system chosen, its also a requirement of British Standards (BS6229:2003) to maintain a roof and guidance on how this should be done can be demonstrated during a site support visit.

## Guarantees

Here's a checklist covering the essential manufacturer support you should receive:

- ✓ Project specific technical support
- ✓ Bespoke design
- ✓ Wind up-lift calculations
- ✓ Cut-To-Falls design
- ✓ Drainage calculation support
- ✓ National Building Specification: J42
- waterproofing, Q37 green roofs, H71/92 zinc
- ✓ Registered installer network
- ✓ On-site support & assessment
- ✓ Guarantees/warranties

## Detailing, compatibilities & interfaces:

A modern single ply roofing system is more than just a waterproofing membrane and incorporates a number of key system accessories. The key ancillaries that should be considered by the specifier to ensure the integrity of the membrane is not compromised are:

- Vapour control layers
- Geotextile separating fleece
- Adhesives and sealants
- Liquid detailing
- Standing seam profile
- Mechanical fixings & clamping bars
- Pre-fabricated details & coated metal
- Walkway membrane
- Thermally efficient insulation
- Big Foot systems
- Roof-pro




These two images show where the integrity of the membrane can compromise the NBS specification by puncturing the membrane, ultimately leading to water ingress




However, by using the correct materials (in the case of this membrane with a FLL certificate) and standard detailing to avoid puncturing the membrane, these roof membrane systems are not punctured at interfaces and do not risk water ingress.





## What not to do!


- Preventable failure: EU €2bn
- Typical failures:
  - Water ingress
  - Wind damage
  - Workmanship
  - Condensation
- Typical reasons:
  - Poor preparation
  - Poor design
  - Poor detailing



Incorrectly  
Installed



Correctly  
Installed



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## Summary

So hopefully you will go away equipped with three sets of knowledge:

### Knowledge

- Defining your client's brief
- Ensuring compliance with UK British Standards and Code of Practice
- Choosing the best roofing system for the job
- When to specify single ply / hot melt / hard metals / liquid coating
- Green roofing options
- Further sources of information / contacts

### Modern roof performance

- Waterproofing
- Insulation
- Sustainability
- Energy capture

### Manufacturers' responsibilities

- Design bespoke roofing solutions to meet a client's specific brief
- Ensure compliance with UK British Standards and Code of Practice
- Supply, install and guarantee complete roofing solutions
- Ensure performance through effective detailing, compatibility and interfaces

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## About SIG

As part of SIG plc a FTSE 250 listed company, we are committed to supporting the construction industry through the provision of exceptional roofing solutions to aid design, performance and aesthetic considerations. SIG plc is the UK's market leading specialist supplier of construction products, a hugely experience part of the supply chain.

As an organisation embedded within the roofing construction section, SIG Design & Technology offer a complete and impartial design and supply service, built around a selection of waterproofing options that are able to meet the specifier's specific requirements.

Roofing expertise and knowledge are just part of the service that we provide absolutely free to our clients. Our processes, which follow eight clearly identified steps, help our clients create the 'Optimal Roof'.

Furthermore, our roofing range includes the design and supply of flat roofs, green roofs, and zinc, copper and stainless steel roofing and cladding with the reassurance of advice, appropriate products and solutions, PI Insurance and fully system guarantees.

## More information

Website: [www.singleply.co.uk](http://www.singleply.co.uk)

SIG Zinc & Copper website: [www.sigzincandcopper.co.uk](http://www.sigzincandcopper.co.uk)

Technical blog: [www.singleply.co.uk/blog](http://www.singleply.co.uk/blog)

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