

Technology III



Roof
Construction

Functions of roofs

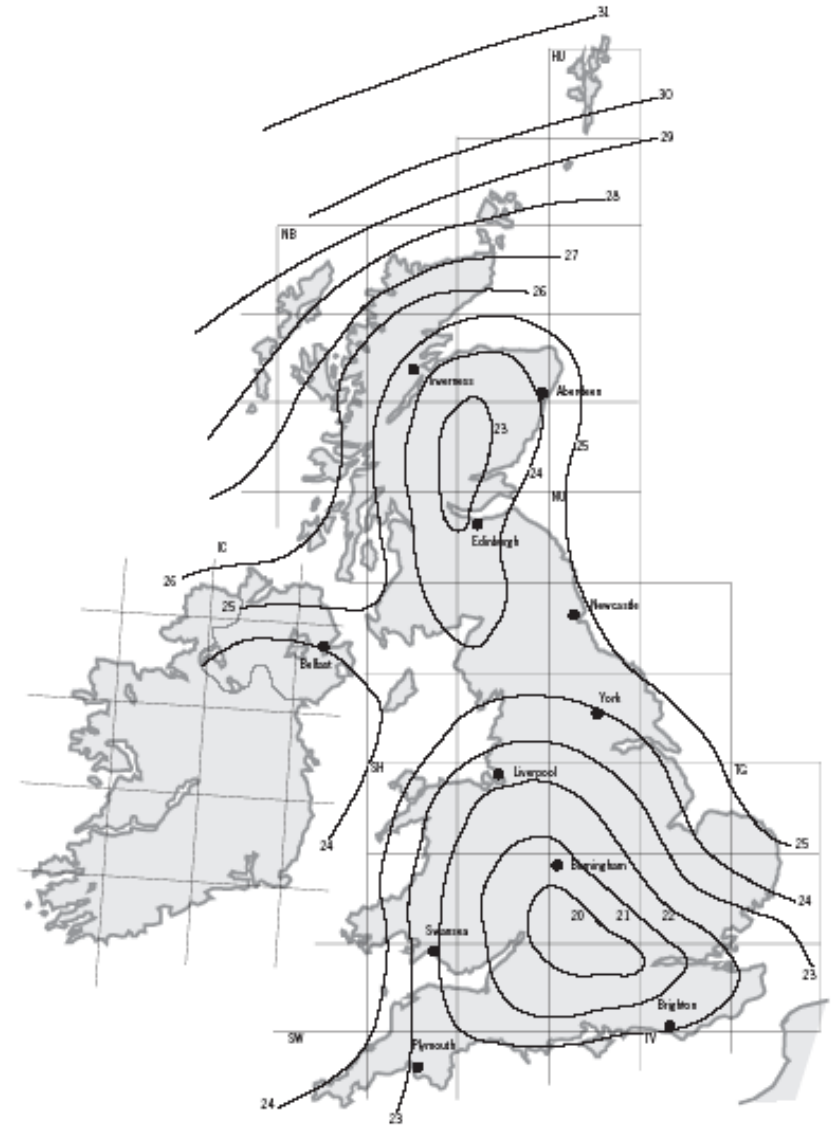
- Strength and stability
- Dimensional stability
- Exclusion and disposal of rain and snow
- Energy conservation and ventilation
- Control of solar heat, air temperature etc

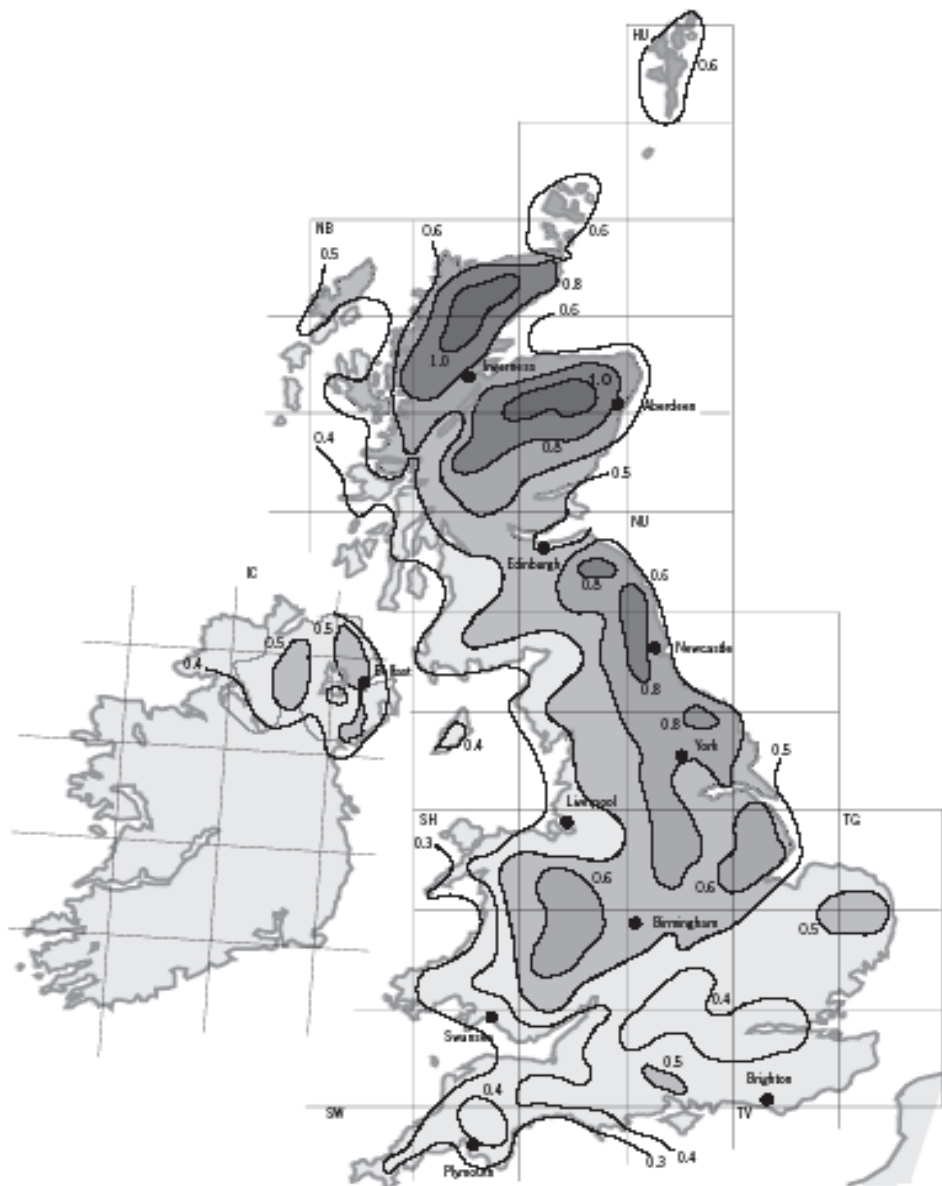


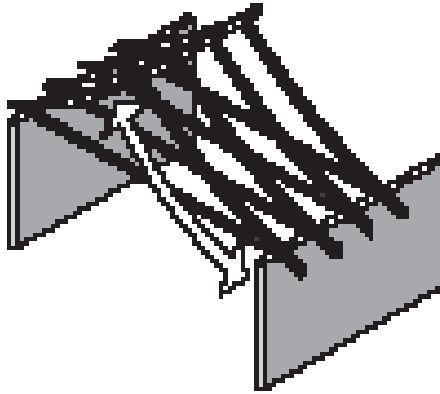
Functions of roofs



- Fire precautions and lightning protection
- Daylighting, control of glare etc
- Sound insulation
- Durability and ease of maintenance



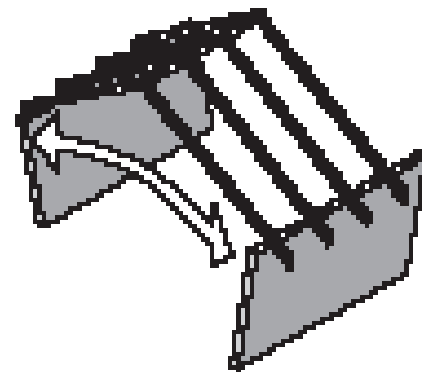
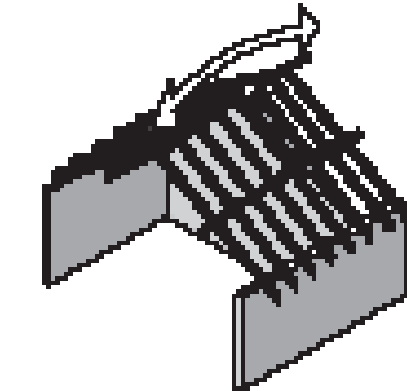




Dimensional stability

Expansion and contraction

- Moisture movement
- Thermal movement



Exclusion and disposal of rain and snow



- Vertical rain
- Driving rain
- Rain splashing
- Hailstones and snow
- Disposal of rainwater and snow meltwater

Rainwater disposal



Ponding occurred
because the
outlet has been
set too high.

Energy conservation and ventilation

- Prevention of heat loss
- Condensation
- Pressure differentials
- Water in materials



Thermal insulation



Asphalting a warm deck roof. The thermal insulation (urethane with a perlite topping) was selected so as not to be affected by the heat of the asphalt while laying; it protects the metal deck from excessive thermal movements.

Control of solar heat, air temperature etc

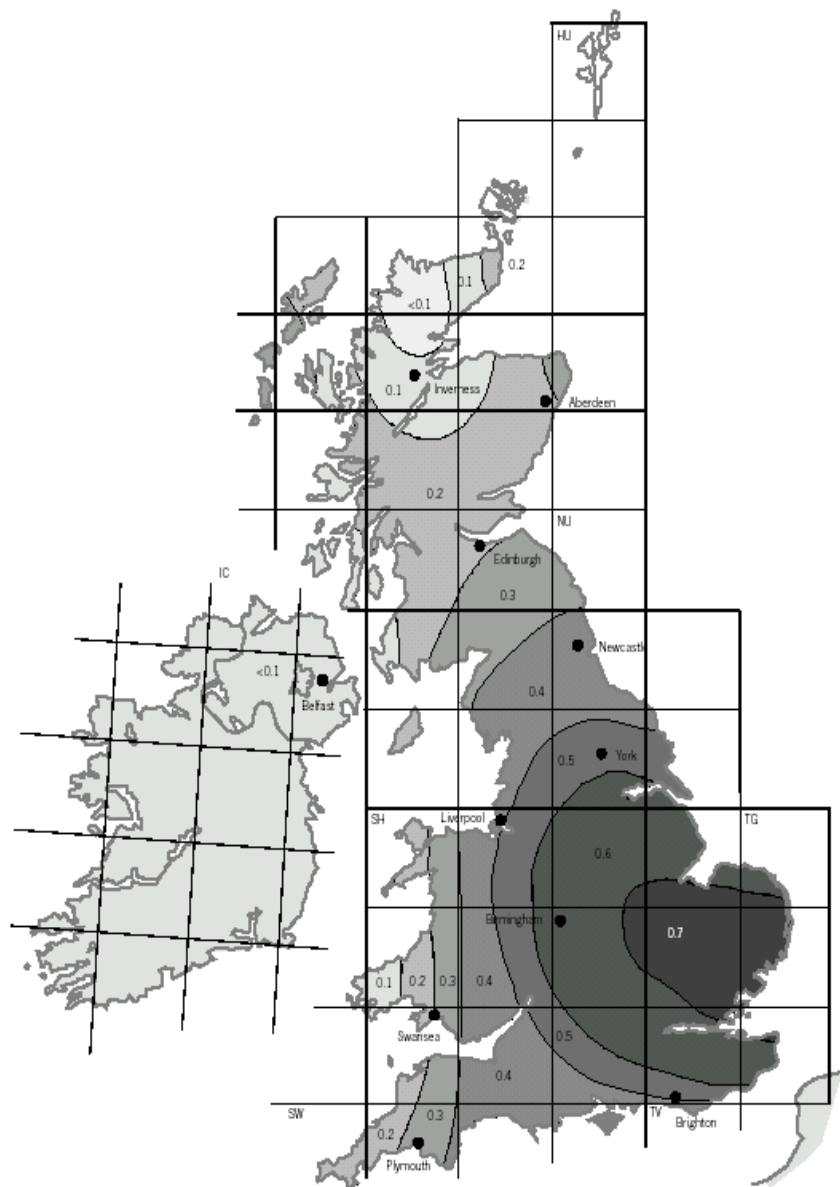
- Solar energy
- Temperature prediction
- Frost



Fire precautions and lightning protection



- Reduce outbreaks
- Escape of occupants
- Minimise the spread
- Control fire growth
- Avoid conflagration



Daylighting, control of glare etc

- Daylight factor
- Reflection
- Roof lighting



Sound insulation



- Air-borne
 - Internally generated
 - Externally generated
- Structure-borne
 - Machinery
 - Weather generated

Durability and ease of maintenance

- Pollutants
- Insects
- Rodents, bats and birds
- Mould, fungus etc
- Plants



Durability



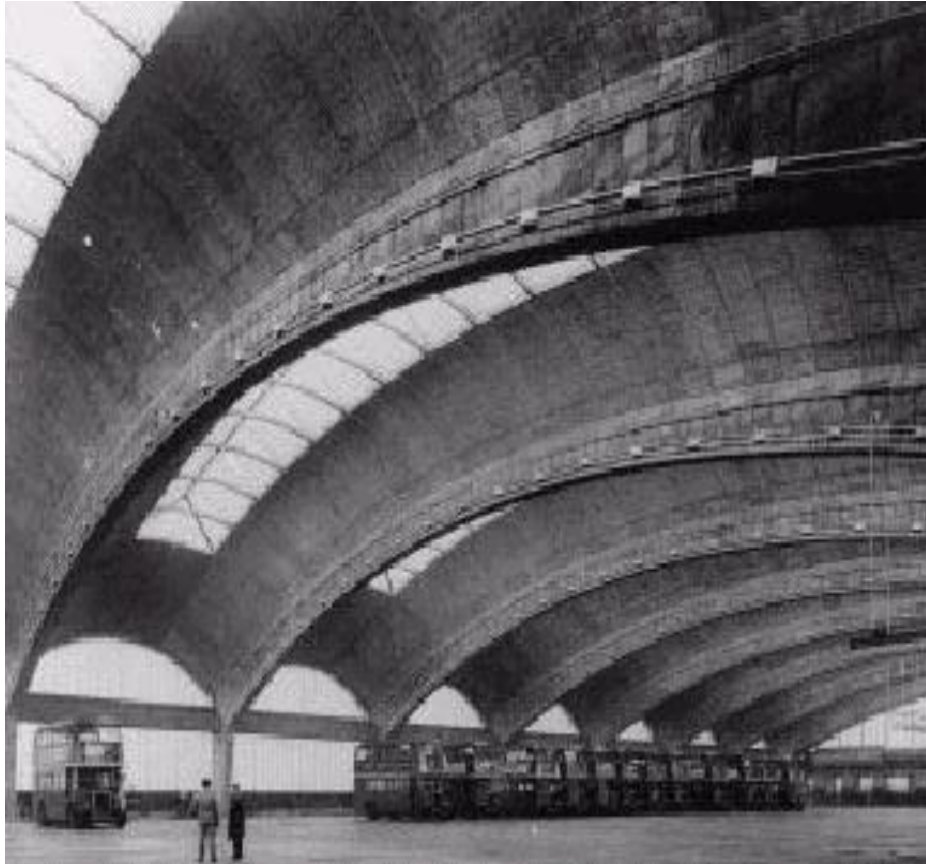
This ribbed stone vault does not have a separate weatherproof covering. Durability of the roof depends on many factors including correct selection of the stone and its bedding planes, suitable mortar mixes and air pollution levels

Protecting our heritage



Mastic asphalt

Long span roofs



From this...



...to this



Factors affecting choice of roof structure



- Building type
- Foundation condition
- Spans





Tapered roofing

Factors affecting choice of roof structure



- Loading
- Lighting requirements

Factors affecting choice of roof structure

- Service accommodation
- Possible future alterations
- Speed of erection



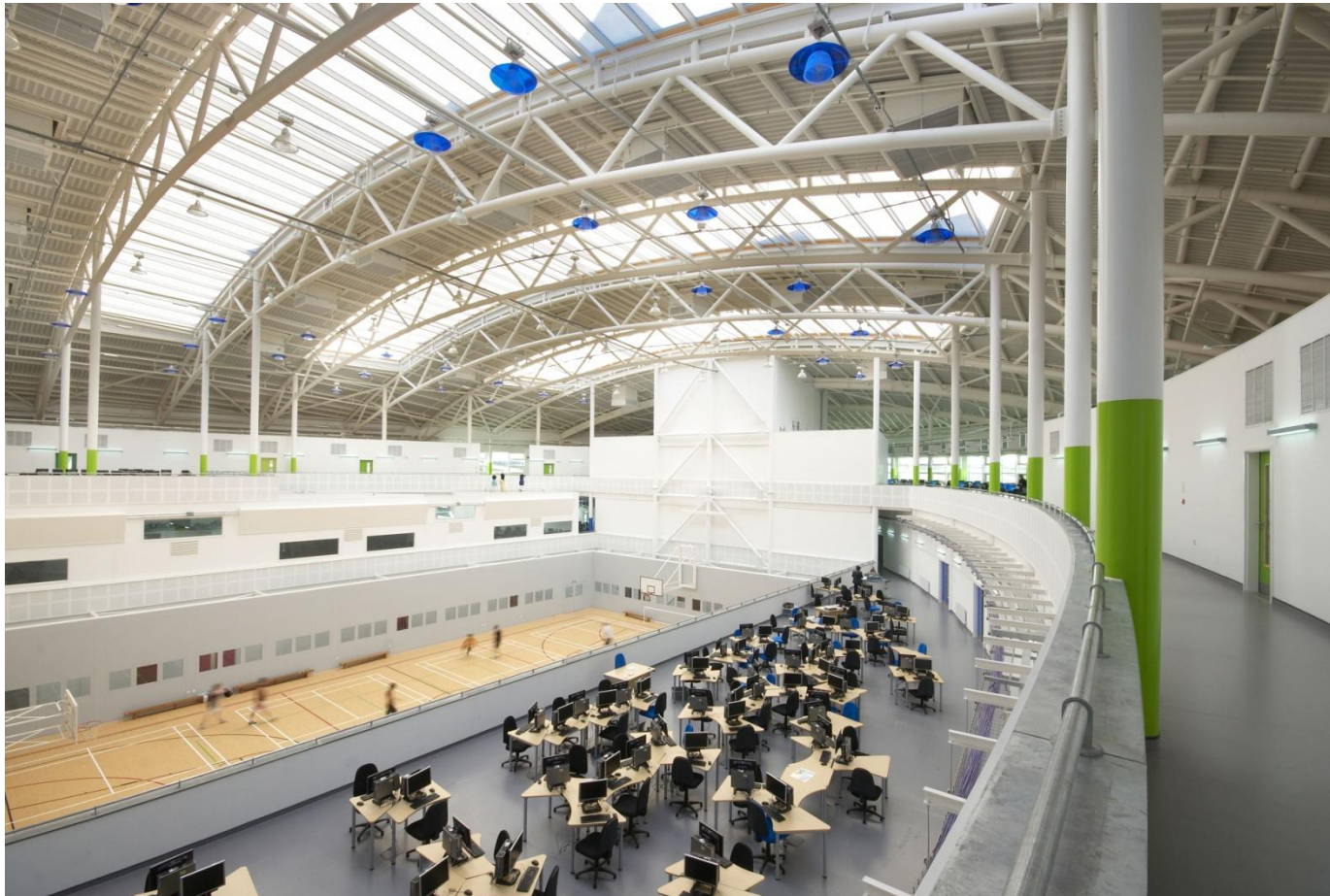


Factors affecting choice of roof structure



- Aesthetic considerations
- Internal height





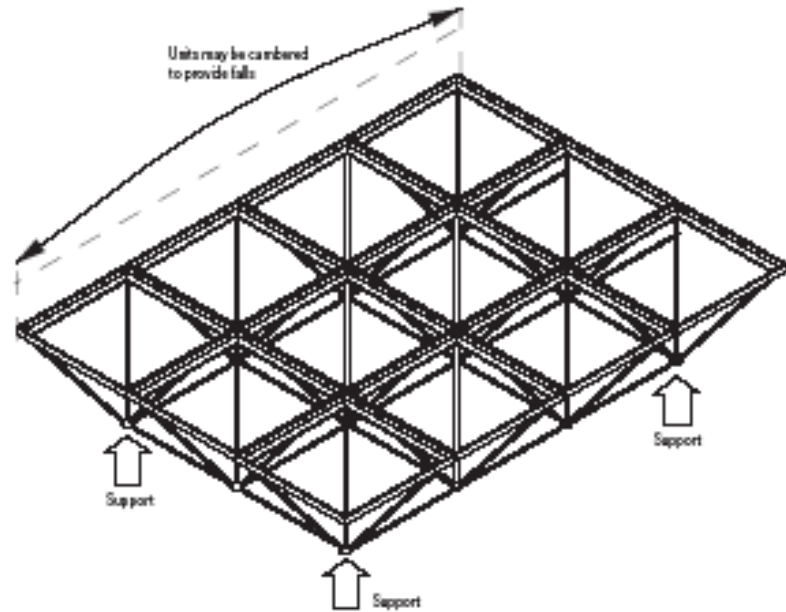
An intelligent roof approach – catering for the needs of the occupants as well as For itself!

Obsolescence

What determines the
Life expectancy of a roofing
System?



- Physical
- Economic
- Functional
- Technological
- Social
- Legal



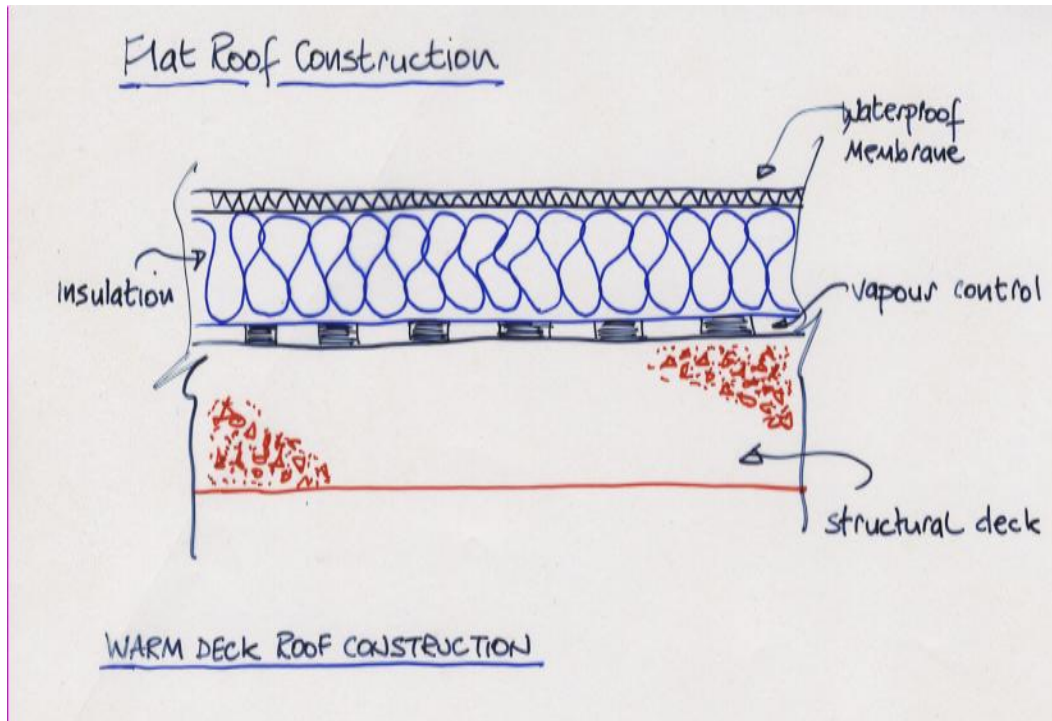
Sustainable roofs!



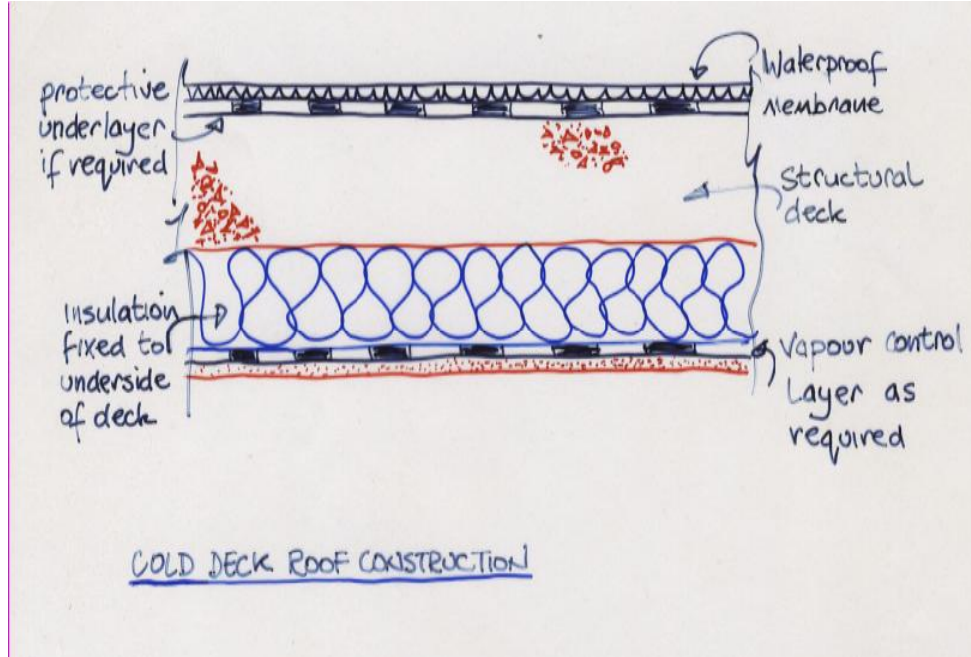
- Orientation
- Overhangs
- Rooflights
- Inverted flat roofs
- Ballasted membranes
- Green roofs
- Stones / ballast heat sinks
- Good detailing
- Over-design
- Adequate specification

Roof Construction

- Warm deck
 - Insulation warms the deck
 - Waterproof membrane externally
 - Vapour control needed under insulation to prevent condensation

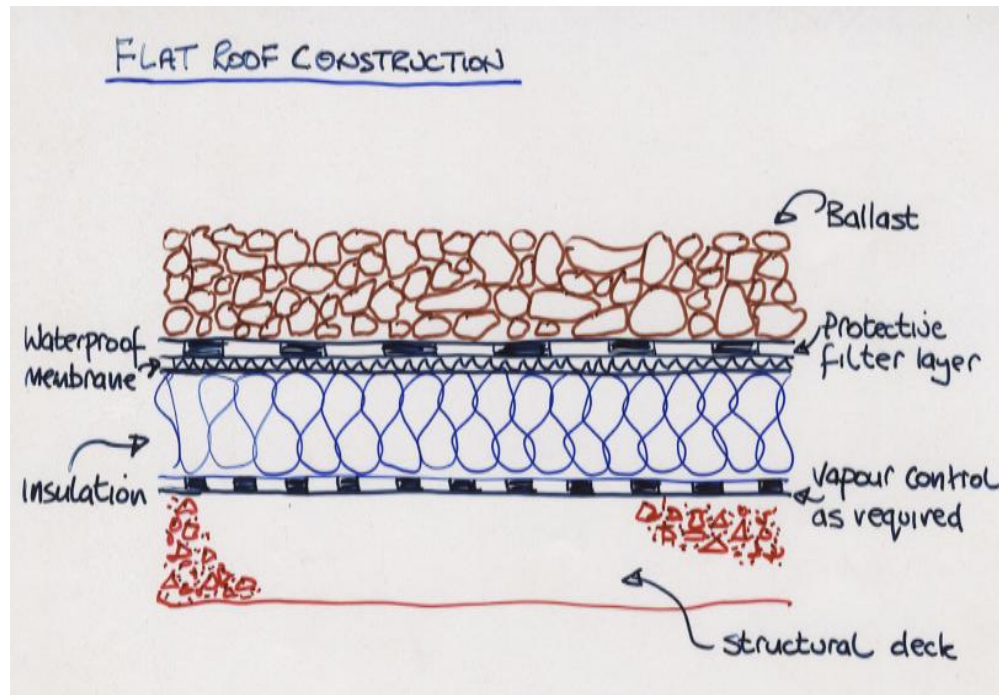


Roof Construction



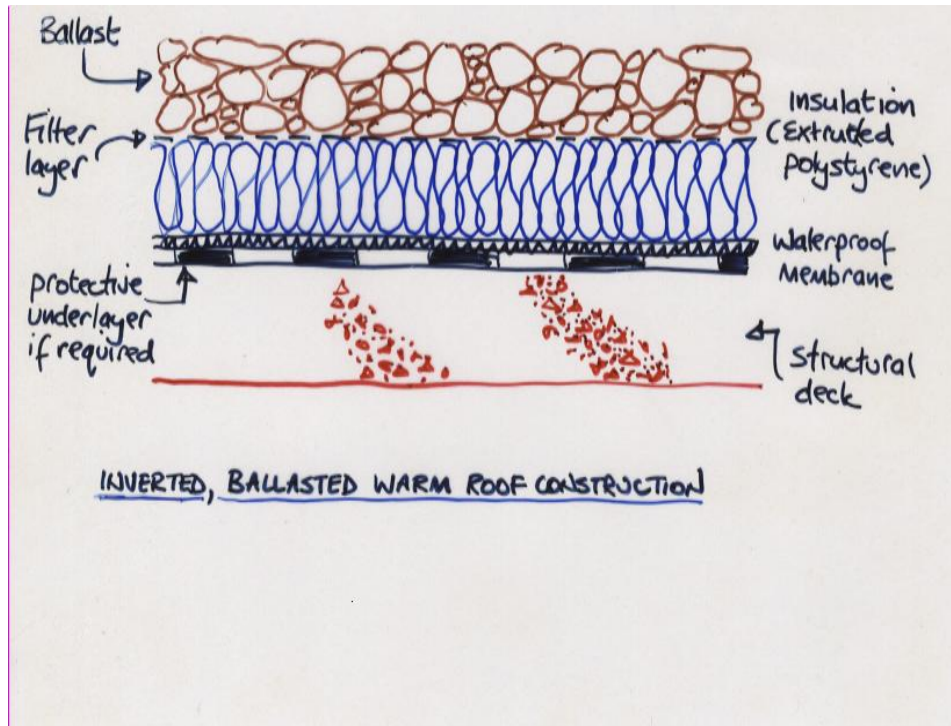
- Cold deck system
 - Vapour control under insulation to reduce condensation risk
 - Difficult to ensure integrity of VC
 - Deck not warmed by building
 - Poor option in UK – temperate, humid climate, sheltered conditions (lack of ventilation)

Roof Construction



- Conventional ballasted warm roof construction
 - Insulation keeps the deck warm
 - Waterproof membrane is above insulation
 - Vapour barrier needed below insulation to reduce risk of condensation

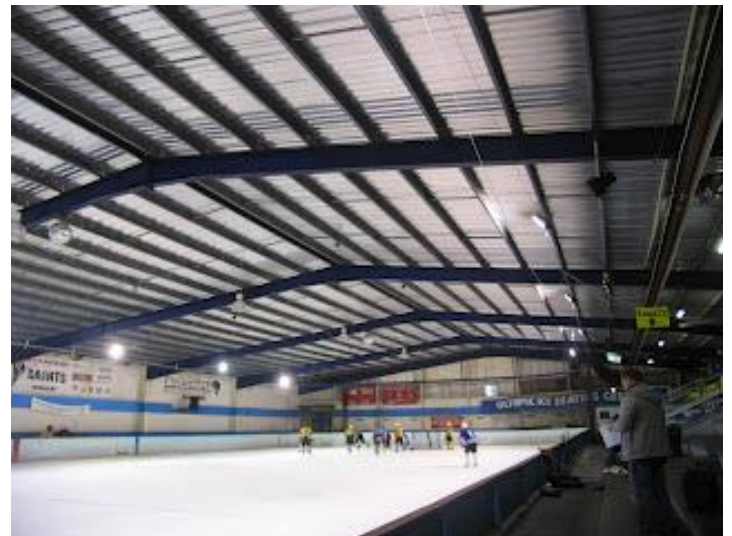
Roof Construction



- Insulation above the deck provides protection to the membrane and deck from extremes in temperature.
- Some challenges:
 - Grit
 - Degradation
 - Condensation



The odd shapes of
Roofs!



Case Study: Green Roofs

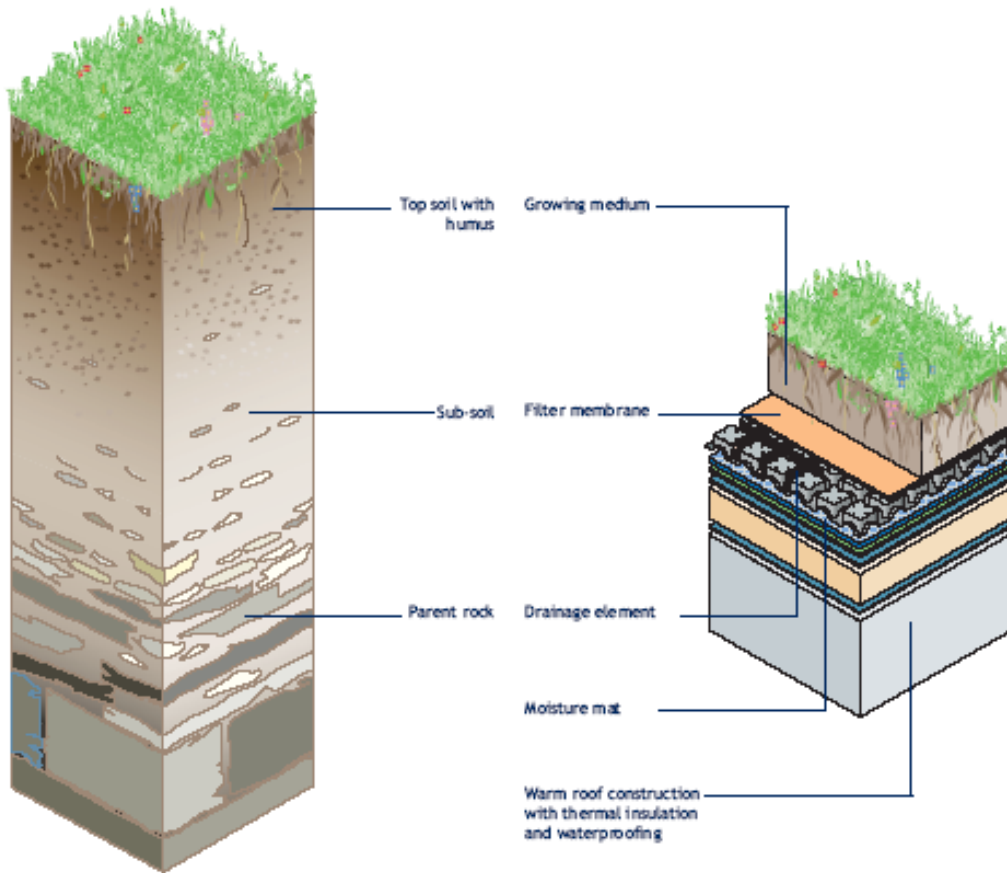


Why have a green roof?

- Water retention
- Climate control
- Life expectancy
- Pollution control
- Thermal insulation
- Space use
- Encourages natural habitats



Replicating nature



- Nutrients
- Water retention
- Aeration
- Drainage

Inverted Green Roof

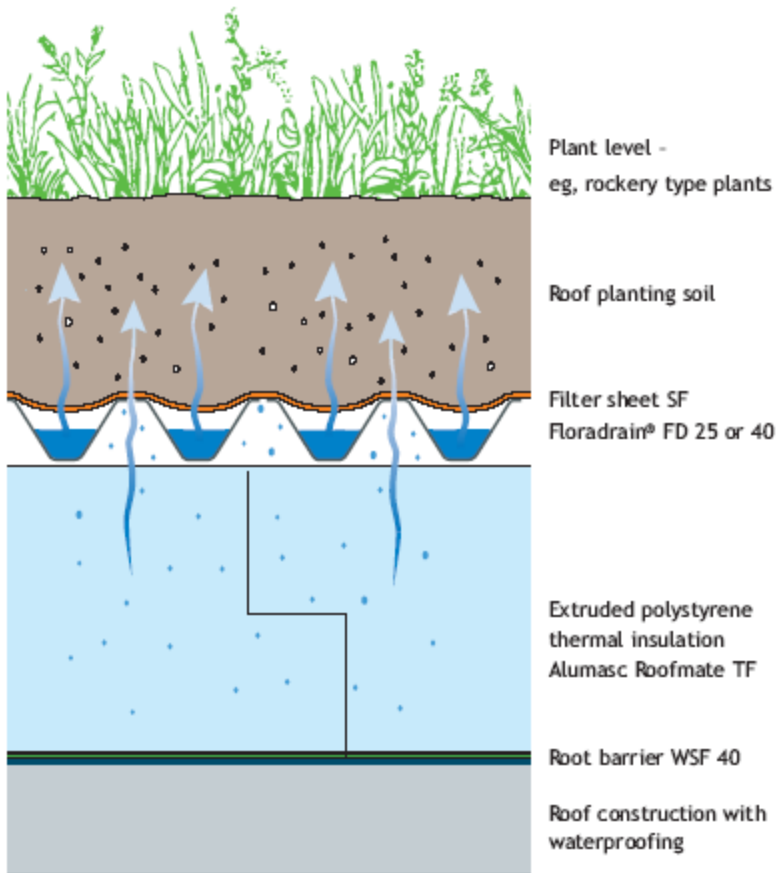
Some key points:

Root barrier

Wind uplift

Water storage

Irrigation



Some Barriers!



Structural issues

Maintenance

Guidance and support

Guarantees

Aesthetics

Research: the Swiss experience



Local substrates

Depth variation

Planting

Biodiversity

Discussion

Explain what is meant by a warm roof. How does this differ from an inverted and cold roof systems?

Examine each of the performance requirements of roofs as applied to both medium and long span systems.

Examine the key factors that are likely to cause instability or deformation in a long span roof.

Compare and contrast the use of a fabric as a roofing material with that of a more rigid sheet system.

What is meant by a sustainable roof system?