

GOLDEN RULE: Function dictates design, and design guides delivery.

DESIGN

GRADE 1 BASIC UTILITY
- Car Parking
- Plant Rooms/ Workshops
EXCLUDING electrical equipment
SOME SEEPAGE AND DAMP PATCHES ARE TOLERABLE

GRADE 2 - BETTER UTILITY
- Retail storage areas - Plant Rooms / Workshops - with electrical equipment
NO WATER PENETRATION BUT SOME MOISTURE VAPOUR TOLERABLE

GRADE 3 HABITABLE
- Residential - Offices
- Leisure Centres etc
VAPOUR DRY ENVIRONMENT

Type A - Barrier Protection - Continuous barrier around the structure.

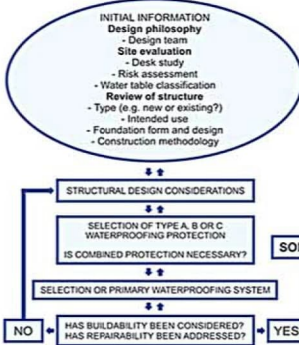
Type B - Structurally integral Protection - Waterbar / Hydrophilic Strips

Type C - Drained Protection - Draining internal cavities from vapour, condensation and minor seepage

Know the function

Know the grade

Know the Type



Term	Reference	Nomenclature	Decision maker
Grade	BS 8102 ²⁴	Grade 1 Basic Better utility Habitable (Special) (4)*	Client
Type	BS 8102	Type A Barrier protection Structurally integral protection Drained cavity protection	Design team
Form	Various e.g. CIRIA Report K140 ²⁴	Forms of construction, which for reinforced concrete construction include slabs, walls, beams, piles, diaphragm walls, capping beams etc. Viable forms of construction will depend on method of construction	Design team
Tightness Class	BS EN 1992-3 ²⁴	Tightness Class 0 Some degree of leakage acceptable Limited leakage: any cracks should heal Leakage minimal: staining acceptable. No leakage: special measures (e.g. liners) needed	Structural Engineer

Water table Classification*	Types of water-resisting construction		
	Type A (barrier protection)	Type B (structurally integral protection) Piled wall	Type C (drained protection) RC wall to BS EN 1992
Low	Acceptable	Acceptable	Acceptable
Variable	May be acceptable if 'variable' Classification is due to surface water: seek manufacturers' advice	Acceptable where a) the piled wall is directly accessible for repair and maintenance from inside the structure or b) the piled wall is combined with a fully bonded waterproofing membrane or c) the piled wall is faced with a concrete wall to BS EN 1992	Acceptable
High	May prove acceptable where a concrete wall to BS EN 1992 is used or where cementitious renders or coatings are used	Acceptable	Acceptable



Chosen basement and Waterproofing Specification.

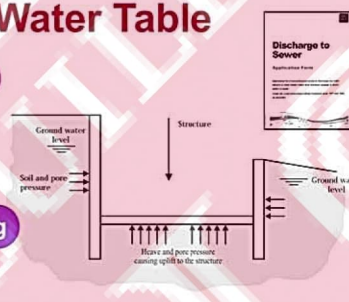
Tables Reference from Guidance on the design and construction of in-situ concrete basement structures EuroCode and MPA Concrete Society *

Decision makers decide the grade type form and tightness class together with a water table review to determine the waterproofing specification

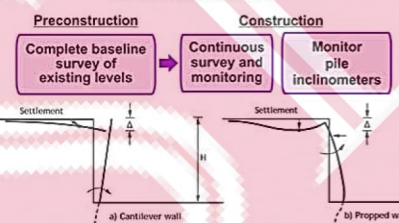
CONSTRUCTION

Know Your Water Table

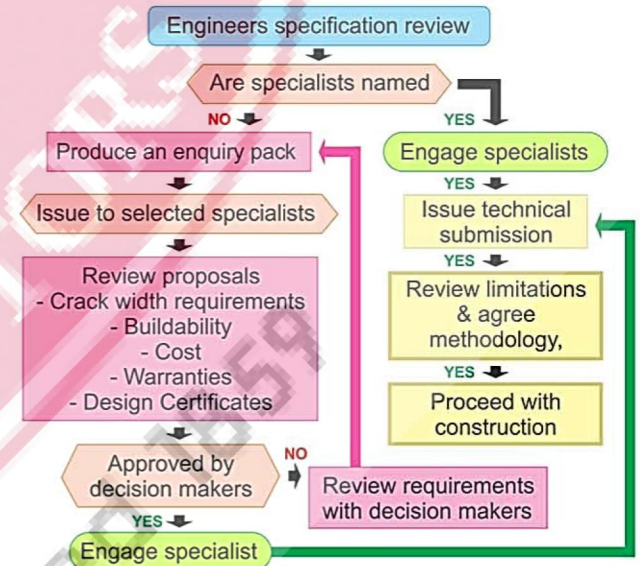
- How will I control it?
- Are discharge licences required?
- When can I stop pumping?
- Monitor Well Points



Ground Settlement Controls



Water Proofing Product Selection Criteria



Temporary Propping



Typical temporary propping layout with bespoke construction sequencing

- Is propping required?
- Who designs them?
- Buildability - Hazards? Solution - Cantilever Pile/Props/Anchors
- Installation - Sequence?
- Extraction - Ground Settlement?



Temporary propping may result in bespoke waterproofing details around the propping elements.

QUALITY CONTROL

Crack Size Table

Limit state	Limiting crack width (mm)	Comments
Durability	0.3	For all exposure classes except XC1 (National Annex to EN1992-1-1, Table NA.4) in which case appearance is often the main criterion, although the preservation of aggregate interlock for shear strength should be considered (see also Table 2.2).
Serviceability (in water retaining structures)	0.05 to 0.2	For sealing, under hydrostatic pressure (EN1992-3 Cl.7.3.1).
Appearance	0.3, or greater	Depends upon specific requirements for appearance (National Annex to EN1992-1-1, Table NA.4). *

- Where limiting crack widths are 0.05-0.2 hydrostatic pressure activates free cement within the structure to seal the crack
- Avoid strong concrete mixes
- Use GGBS or Fly Ash to reduce the cement content, reducing heat generated while curing

Pour Size Table

Pour sizes are a fundamental to the design. Check drawings and specifications for maximum pour sizes. This table is a "Benchmark for Discussion".

Construction	Maximum Area (m ²)	Maximum Dimension (m)
Water - resisting walls	25	5
Water - resisting slabs	100	10
Slabs with major restraint at both ends	100	13
Slabs with major restraint at one end only	250	20
Slabs with little restraint in any direction	500	30
Walls	40	10

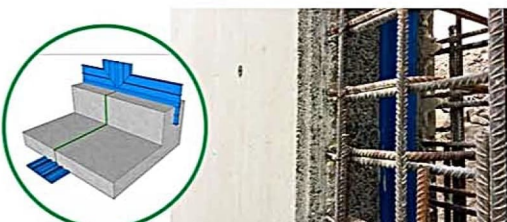
- Avoid movement joints
- Plan pour sizes with the design team
- Consider placement method and rate of pour

Curing Table

Concrete Members	Minimum Period before Removal of Formwork and Formwork Supports
Softs of beams, soffits of decks, soffits of slabs, soffits of cantilevers, soffits of diaphragms, soffits of pier and abutment crossheads and soffits of other structural members	7 days or until such time as the concrete has reached the specified 7 day compressive strength, whichever is the greater
(a) Vertical faces of members when height of each day's cast is: (i) Columns - greater than 7 metres (ii) Walls - greater than 4 metres	5 days
(b) Load supporting sides of sloping walls of box girders	
(c) Vertical faces of members when height of each day's cast is: (i) Columns - 4 to 7 metres (ii) Walls - 2 to 4 metres	3 days
(d) Vertical faces of beams and pier and abutment crossheads (e) Vertical faces of pad footings	
Vertical faces of members when height of each day's cast is: (i) Columns - less than 4 metres (ii) Walls - less than 2 metres	2 days
Sides of slabs and piles	1 day

- Construct at low ambient temperatures to limit temperature differential.
- Minimize time between adjacent pours.
- Lost wall tie is preferred where required.
- Use damp hessian blankets and protect surfaces from exposed conditions.

Day Joints



- Prepare joint surface for good key
- Clean excess concrete before pour
- Ensure WB is adequately supported to prevent folding during pour
- Inspect prior to, and during pour

Penetrations



- The design team and product manufacturer must develop site specific details
- The site workmanship for penetrations is critical and should be continuously monitored.
- Agree a benchmark sample with the installer, product manufacturer and designer prior to commencing



Workmanship



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