

PARAMETERS AFFECTING SETTING TIME

Fly ash pH value

- pH > 11 flash-setting (5 minutes after mixing)
- $8 < \text{pH} < 11$ rapid setting
- pH < 8 optimal value

CaO content

- CaO content can affect the pH of fly ash and influence the setting time

Sodium silicate/Sodium hydroxide (S/N)

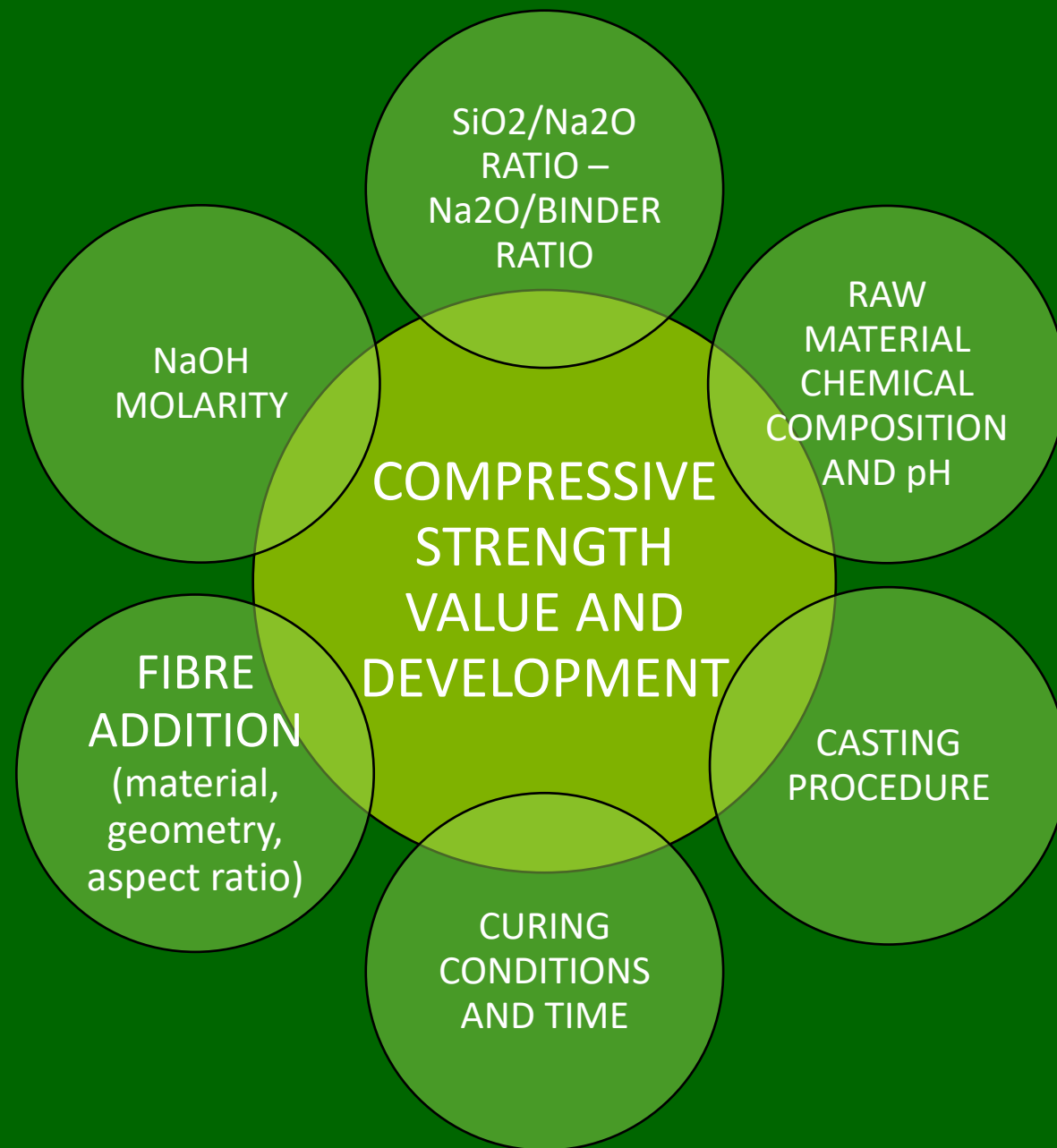
- A higher content of silicates increases the setting time

Temperature

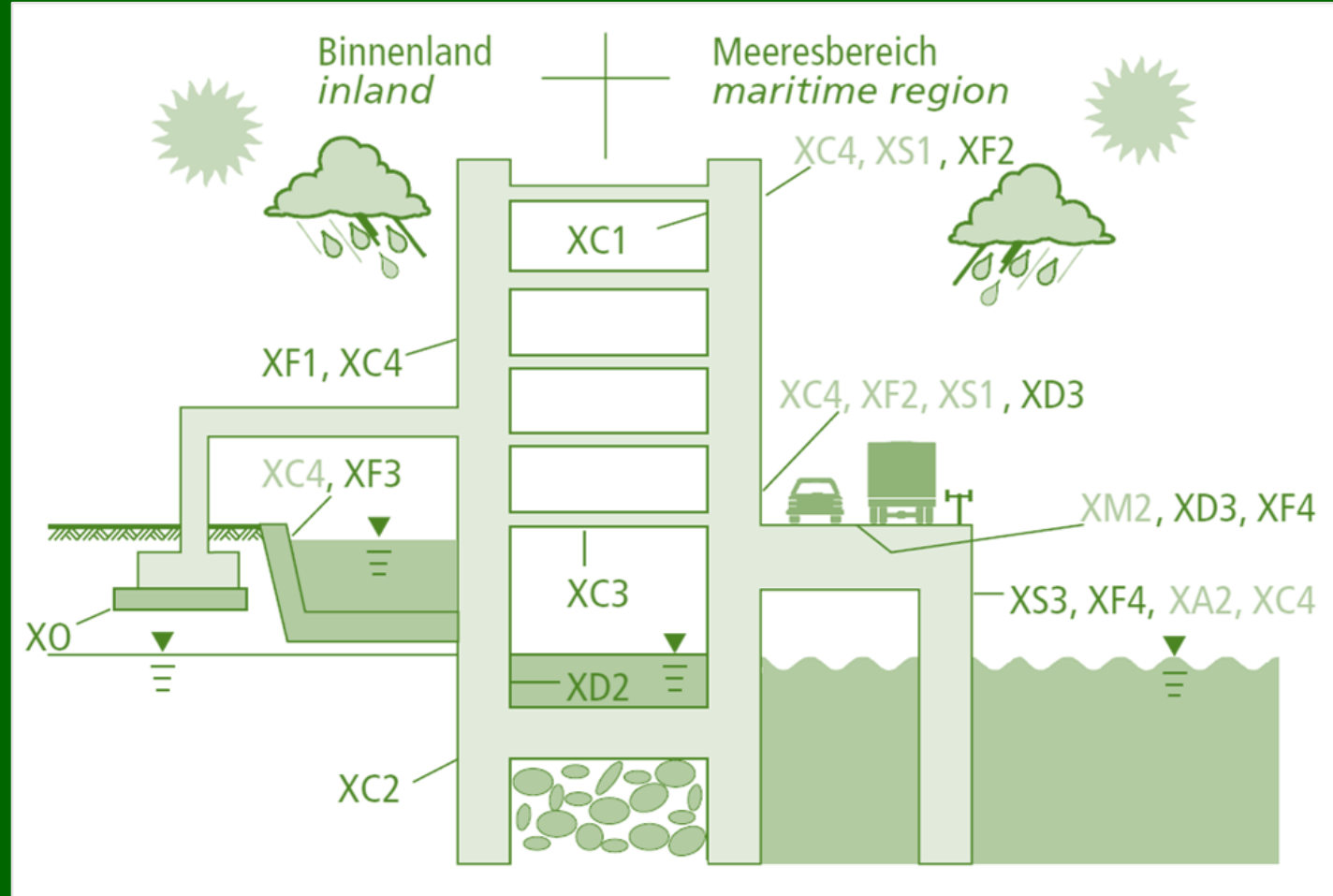
- Heat development due to the addition of the solution in the mixing phase can lead to rapid setting
- Pre-mixing the activators (24 hours) before the casting help to reduce the mix temperature and to prevent fast setting

Absence of suitable admixture for AAMs

- Admixture used in OPC-based concrete as retarder (to increase the initial setting time) behave differently in AAMs, especially in low-CaO content systems



Expositionsklassen (Umwelteinwirkungen, „Angriffe“) Exposure classes (environmental effects, „attacks“)			Betontechnische Maßnahmen („Widerstände“) Concrete technology measures („resistances“)			
Klassenbez. class designation	Einwirkung effect and Beanspruchung stress		Max. w/z max. w/c	Min. z min. c	f _{ck} , cube f _{ck} , cube	
XO	kein Angriff no attack	kein Betonangriff no concrete attack	keine Anforderung no requirement	keine Anforderung no requirement	C8/10 C8/10	
XC	Carbonatisierung carbonation	1 trocken dry	0,75	240	C16/20	
		2 ständig nass constantly wet	0,75	240	C16/20	
		3 mäßig feucht moderately moist	0,65	260	C20/25	
		4 nass / trocken wet / dry	0,60	280	C25/30	
XD/ XS	Chlorid chloride	1 mäßig feucht moderately moist	0,55	300	C30/37	
		2 ständig nass constantly wet	0,50	320	C35/45	
		3 nass / trocken wet / dry	0,45	320	C35/45	
XF	Frost /+ Salz freeze-thaw /+ salt	1 mäßige Wassers. o. T. moderate water saturation (o.T.)	0,60	280	C25/30	
		2 mäßige Wassers. m. T. moderate water saturation (m.T.)	0,55 + LP	300	C25/30	
		3 hohe Wassers. o. T. high water saturation (o.T.)	0,55 + LP	300	C25/30	
		4 hohe Wassers. m. T. high water saturation (m.T.)	0,50 + LP	320	C30/37	
XA	Chem. Angriff chemical attack	1 schwach angreifend weakly corrosive	0,60	280	C25/30	
		2 mäßig angreifend moderately corrosive	0,50	320	C35/45	
		3 stark angreifend strongly corrosive	0,45	320	C35/45	
XM	Verschleiß wear	1 mäßiger Verschleiß moderate wear	0,55	300	C30/37	
		2 starker Verschleiß severe wear	0,45	320	C35/45	
		3 sehr starker Verschleiß very severe wear	0,45	320	C35/45	



Which applications are suitable for AAMs?

- Exposure classes define a minimum characteristic compressive strength requirements to be satisfied by the material used (AAMs should satisfy these requirements)
- Specific applications require additional properties, but not necessarily a minimum compressive strength value:
 - High-rise building: **early strength** development (time saving) and high compressive strength (material and cost saving)
 - Shotcrete: high early strength and **fast setting**
 - Repair and retrofitting: **high durability**

ALKALI-ACTIVATED CONCRETE - APPLICATIONS



FIBRE-REINFORCED AAMs – FUTURE APPLICATIONS



Agricultural

Farm and animal storage structures, walls, silos, paving, etc.



Airports & Ports

Runways, taxiways, aprons, seawalls, dock areas, packing and loading ramps



Highways, Roadways & Bridges

Conventional concrete paving, SCC, barrier rails, curb and gutter work, etc.



Mining & tunnelling

Precast segments and shotcrete, which may include tunnel lining, shafts, slope stabilization, sewer work, etc.



Precast elements

Precast pre-stressed roof elements & beams, façade panels, tanks, containers, pipes, piles, etc.



Residential

Driveways, sidewalks, basements, colored concrete, foundations, drainage, etc.



Shell structures

FRC is well suited for complex shapes, where fibres combine with traditional reinforcement to obtain thicker sections



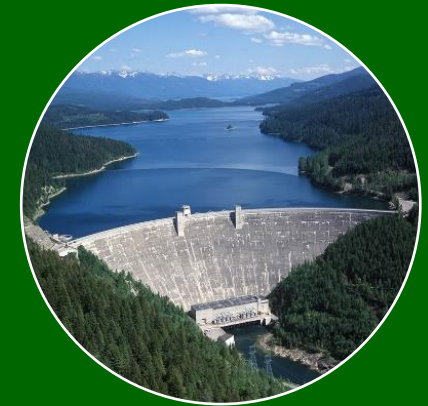
UHPFRC

Civil structures and bridges, building components, etc.



Warehouse & industrial

Light- to heavy-duty loaded floors and roadways



Waterways

Dams, lock structures, channel linings, ditches, storm-water structures, etc.

