

Cracking process



Cracking process

- Reinforced concrete design assumes that concrete does not withstand tension stresses induced by bending
- Steel reinforcement is provided to resist these stresses
- Concrete in tension zone will crack and measures are taken to provide sufficient reinforcement
- Structural members should not be cracked to be acceptable functionally and visually
- Excessive external loading leads to structural cracking
- Internal tensile stresses caused crack (non-structural cracking) compounded by creep

Cracking process



Types of cracks

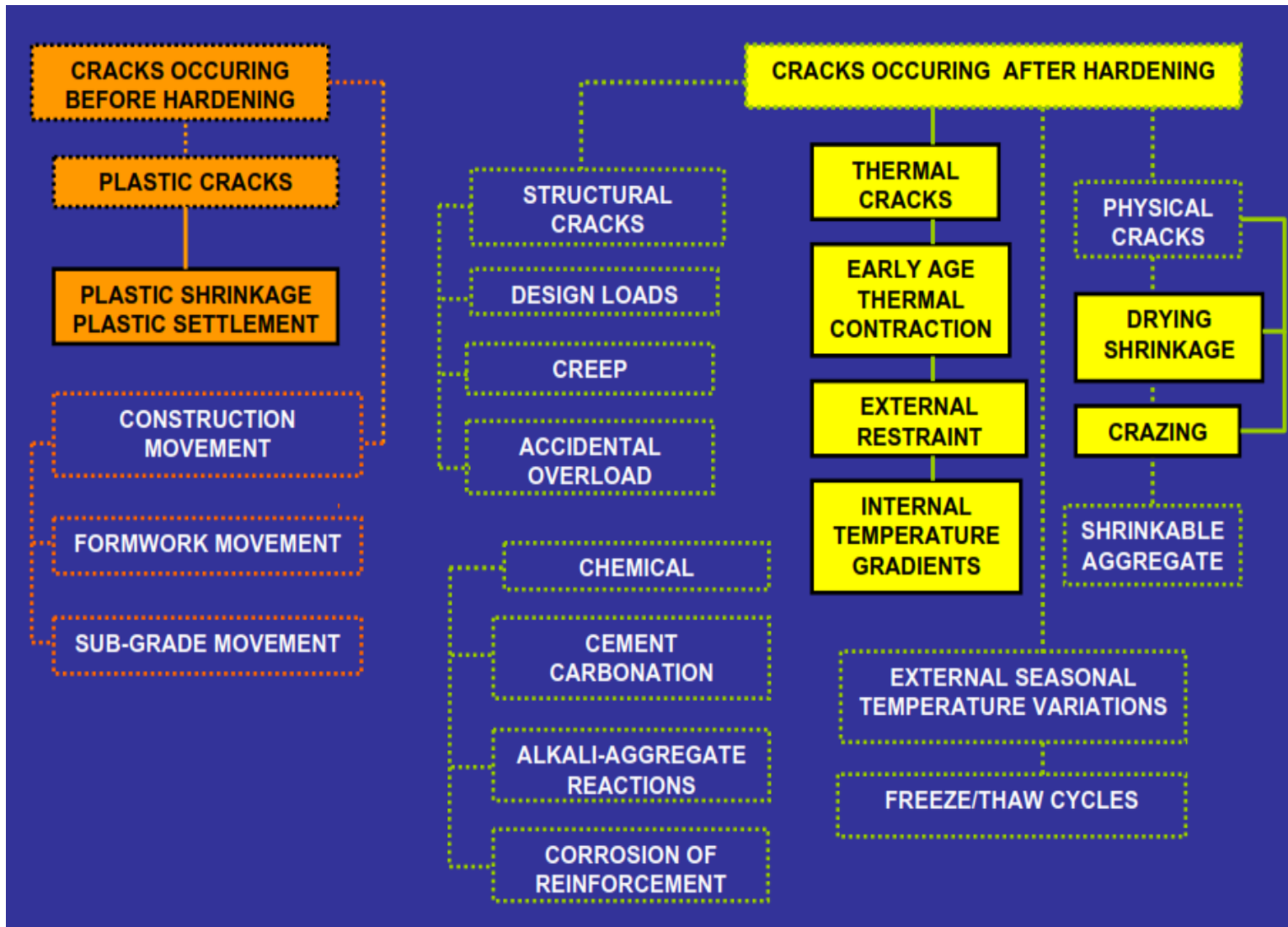
- **Before hardening**

- ✓ Plastic shrinkage cracks
- ✓ plastic settlement cracks

After hardening:

- ✓ Three categories of intrinsic (non-structural) cracks: physical, chemical and thermal like drying shrinkage cracks, early-age thermal contraction cracks
- ✓ Structural cracks

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cracks type

Type of cracking	Subdivision	Most common location	Primary cause (excluding restraint)	Secondary cause or factor	Remedy*	Time of appearance
Plastic settlement	Over reinforcement	Deep sections	Excess bleeding	Rapid early drying	Reduce bleeding/air entrainment or revibrate	Ten min. to three hours
	Arching	Top of columns				
	Change of depth	Trough and waffle slabs				
Plastic shrinkage	Diagonal	Roads and slabs	Rapid early drying	Low rate of bleeding	Improve early curing	30 min. to six hours
	Random	Reinforced slabs				
	Over reinforcement	Reinforced slabs				
Early thermal contraction	External restraint	Thick walls	Excess heat generation	Rapid cooling	Reduce heat and/or insulate	One day to two or three weeks
	Internal restraint	Thick slabs	Excess temp. gradients			

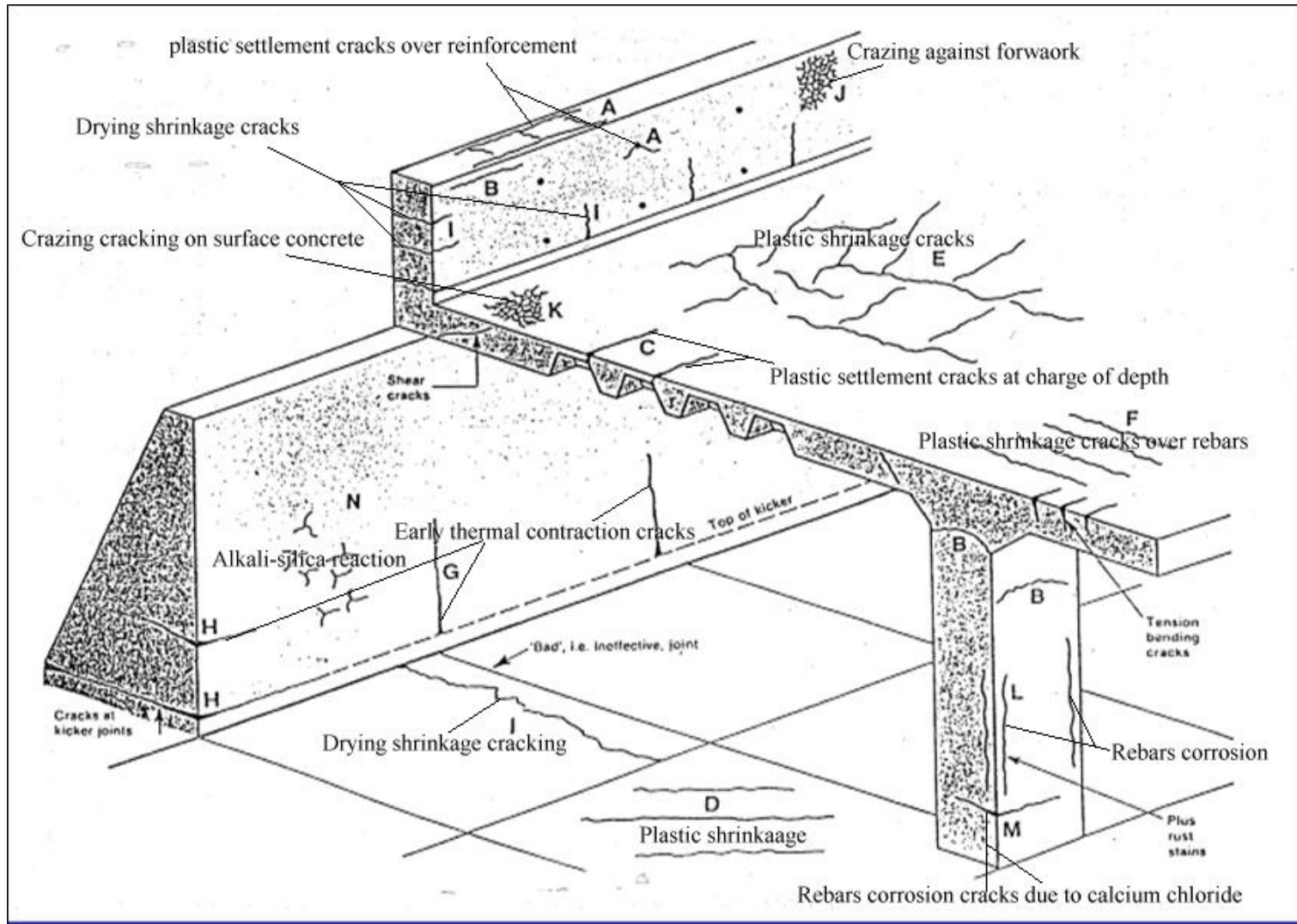
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Long-term drying shrinkage		Thin slabs and walls	Inefficient joints	Excess shrinkage; inefficient curing	Reduce water content; improve curing	Several weeks or months
Crazing	Against formwork	'Fair faced' concrete	Impermeable formwork	Rich mixes; poor curing	Improve curing and finishing	One to seven days, or even later
	Floated concrete	Slabs	Over-trowelling			
Corrosion of steel reinforcement	Natural	Columns and beams	Lack of cover	Poor quality concrete	Eliminate causes listed	More than two years
	Calcium chloride	Precast concrete	Excess calcium chloride			
Alkali-silica reaction		Damp locations	Reactive aggregate plus high alkali cement		Eliminate causes listed	More than two years

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- Some cracks are not necessarily dependent on time (crazing)
- Other types are related to particular conditions (alkali-silica reaction or excessive use of calcium chloride leading to corrosion of steel reinforcement)

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- Plastic cracking (between 1-8 h after placing)
 - Plastic settlement cracking
 - Plastic shrinkage cracking